SCIENTIFIC AMERICAN

Entered as second class matter June 18, 1879, at the post office at New York, N. Y., under the Act of March 3, 1879.

COVER DRAWN BY EDGAR WITTMACK

CUTTING THROUGH THE TANGLED RUINS OF WAR WITH THE OXY-ACETYLENE TORCH [See page 264]

Vol. CXX. No. 11
March 15, 1919

Published Weekly by
Scientific American Publishing Co.
Munn & Co., New York, N. Y.

Price 10 Cents
$5.00 a Year

PIPER HEIDSIECK
CHEWING TOBACCO

Champagne Flavor

The juices of vine-ripened grapes and prime old Burley tobacco—pressed together—give Piper Heidsieck its fruity, cordial flavor of Champagne. It costs somewhat more, naturally, for it is not an ordinary chewing tobacco.

Guaranteed by
The American Tobacco Co.
INCORPORATED

If this Advertisement appeals to you stop at the first tobacco shop and buy a package of Piper Heidsieck

THE UNINTERRUPTED DISTRIBUTION of perishable goods is vitally important to all classes. The motor truck is the dependable link in the transportation chain

MOTOR TRUCKS must operate continuously in all weathers.

FISK PNEUMATIC CORD TIRES grip the road and do their share in holding the truck to its schedule in snow or rain.

THEY PERMIT speed, absorb road shocks, reduce fuel and repair bills.

THE TOUGH Fisk non-skid tread insures traction, will not skid and wears long.

BUY FISK Pneumatic Cord Truck Tires for efficiency and economy.

FISK TRUCK TIRES

SEVENTY-FIFTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXX.
NUMBER 11

NEW YORK, MARCH 15, 1919

10 CENTS A COPY
$5.00 A YEAR

North River Bridge (track capacity equal that of 18 tunnels) combined with a railway loop in New Jersey and Manhattan, would solve the freight and passenger problem at the Port of New York. **[See page 256]**

SCIENTIFIC AMERICAN

Published by Scientific American Publishing Co.
Founded 1845
New York, Saturday, March 15, 1919
Munn & Co., 233 Broadway, New York

Charles Allen Munn, President; Orson D. Munn, Treasurer
Allan C. Hoffman, Secretary; all at 233 Broadway

EDITOR IN CHIEF—Charles Allen Munn
EDITOR—J. Bernard Walker
MANAGING EDITOR—A. Russell Bond
ASSOCIATE EDITORS—Austin C. Lescarboura, J. Malcolm Bird

DEPARTMENT EDITORS

Henry Norris Russell, *Prof. of Astronomy, Princeton University*
W. C. Peckham, *Prof. of Physics, Adelphi College*
Victor W. Pagé, *Automotive Engineer*
Harry C. Ramsower, *Prof. of Agricultural Eng., Ohio State Univ.*
H. E. Howe, *Chemical Engineer*
Lieut. Walter S. Willis, U. S. N., *Civil Engineer*
Lynn W. Meekins, *Foreign Trade*
Albert A. Hopkins, *Notes and Queries*

CORRESPONDING EDITORS

H. Diedericha, *Prof. of Experimental Engineering, Cornell Univ.*
Harry S. Hower, *Prof. of Physics, Carnegie Inst. of Tech.*
C. A. Young, *Prof. of Mechanical Engineering, Purdue Univ.*
H. F. Moore, *Research Prof. of Eng. Materials, Univ. of Illinois*
Edward Ellery, *Consulting Chemist, Union College*
John Ritchie, Jr., *Massachusetts Institute of Technology*
R. J. Fogg, *Assoc. Prof. of Civil Engineering, Lehigh Univ.*

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

Relative Efficiency of Bridge and Tunnels

ALMOST persistent and curious fallacy which keeps cropping up in the discussion of the relative advantages of bridges and tunnels for the Hudson River crossing, is that of the greater economy of tunnels. As a matter of fact, measured on the basis of carrying capacity, tunnels cost a great deal more than a bridge. We have no particular interest in bridges as against tunnels, but we have a very particular interest in the truth, and it is most unfortunate that this error should have become so deeply rooted and far spread.

Any two rival systems of transportation must be judged, when we are considering their cost alone, on the basis of their capacity, and since the bulk of the traffic in these days is trolley and train traffic, it follows that the basis of comparison must be that of the number of tracks provided. Thus, the Pennsylvania tubes leading to the 33d Street Station, accommodate two tracks. The proposed North River bridge over the Hudson River will provide 14 tracks, or seven times as much capacity. But the North River bridge will provide, also, wide roadways for a very heavy automobile and motor-truck traffic.

The scheme proposed by Gustav Lindenthal and described elsewhere in this issue, calls for a belt line, with two crossings of the North River, one by bridge and the other by tunnel; and the author of the scheme, who is by no means opposed to tunnel construction, estimates that the capacity of the North River bridge would be equal to that of 18 separate tunnels, which would cost in the aggregate, 200 million dollars as compared with the cost of a North River bridge, of equal capacity, of only 75 million dollars.

Another persistent, though less frequently stated, fallacy, is that of the relatively short life of a bridge as compared with a tunnel. One prominent citizen of New York, who certainly ought to have known better, recently stated that, whereas a tunnel is indestructible, a bridge is subject to constant and rapid deterioration, so much so that, within a comparatively short time, every part of it would have to undergo replacement. As a matter of fact, there is no reason, except that of human negligence, to prevent the inhabitants of this city a thousand years from now traveling over, let us say, the Manhattan Bridge across the East River—not a Manhattan Bridge renewed, but a Manhattan Bridge containing practically every identical ton of material, at least so far as the main elements of the bridge are concerned, that exists in the structure today. All that is necessary is good weather-proof paint, a conscientious inspection, and the freeing of engineering works in this city, once and forever, from the destructive blights of political interference and graft.

So great is the mass of these long-span bridges that their sponsors are never worried by any theories of the so-called fatigue of metal. The proposed North River Bridge, for instance, will never in any part of it be stressed within speaking distance of its elastic limit, and with careful inspection and painting, the structure, once erected, will stand as a supreme monument to the present age of steel construction, not merely for the time of our children and grandchildren, but for unguessed-at centuries to come.

It should be understood, of course, that this perpetuity does not apply to those portions of the bridge that are immediately subjected to direct contact with the traffic, such as asphalt or plank roadways, steel rails and ties. But excepting these, which in the aggregate form only an insignificant portion of the mass of the bridge, the rest of the structure, with a little human care, should be as lasting as the work of those far-distant engineers who piled up the pyramids of the Pharaohs.

The International Institute of Agriculture

ON January 3d the cables announced the death in Rome of David Lubin, the founder of the International Institute of Agriculture, located in that city. Although David Lubin was an American citizen, a Californian, the brilliant constructive work done by him in the foundation, establishment, and progressive development of this remarkable enterprise is less widely known and appreciated in this country, perhaps, than in Europe. It was in 1905 that this vast project was initiated with the support of the King of Italy. Its success is borne witness to by the fact of its rapid growth and extension to include no less than fifty-six countries among its members. Its object was the creation of a world-embracing organization for the study of every phase of agriculture. The questions involved demand the study of the most favorable conditions with respect to the production, distribution and consumption, not only of bread and of meat, and of the cereals and the herds and flocks from which these great food staples are derived, but also of the wool, the linen, the silk and the leather which furnish the clothing of mankind, of the coffee, tea, wine, cider and beer which humanity craves, and of a thousand far-flung products yielded by the bountiful earth for man's comfort, luxury, or health.

Included in the general problem are first the technical problems having to do with machines on the one hand and with fertilizers on the other, and therefore demanding aid both from the natural sciences and the applied sciences; secondly, the economic and social problem concerned in association and coöperation, mutual interchange of information, credit and assistance in general; and, finally, those of the agrarian policies, principles, and laws current in various parts of the world.

The Institute, in fact, forms a vast clearing house for the exchange of mutual information and aid with regard to agricultural matters between the 56 governments which form its members and share its expenses, and no better proof can be given, perhaps, of its vigorous growth within so short a time than the fact that even the Great War was not able to shatter its structure, or notably curtail its activities. It has steadily continued to achieve its objects as stated in Article IX of its Constitution, to the effect that: "The Institute, confining its action to the international domain, shall: (a) concentrate, study and publish, as soon as possible, all statistical and technical or economic information concerning both animal and vegetable products in the different markets of the world; (b) communicate to its members, likewise as promptly as possible, all such information; (c) present upon occasion for the approval of governments, the measures to be taken for the protection of the common interests of agriculturists and for the betterment of the conditions under which they work and live."

The Institute is divided into bureaus or sections, which issue valuable publications, including three monthly bulletins, dealing respectively with agricultural information, statistics, and social and economic institutions; two annuals, relating to agricultural statistics and agricultural legislation, prefaced by a résumé of world legislation; three publications of seasonal or annual notes with respect to the statistics of cereals, the food supplies for domestic animals, and fertilizers; and, finally, a periodic bibliography of agronomy and a large number of monographs upon special questions.

The Institute has an annual income of about $180,000 including the $60,000 grant by the King of Italy, and the subsidies from the governments concerned. This has enabled it to obtain an admirable equipment, the chief feature of which is its library, which contained 70,000 volumes even five years ago, besides being in receipt of some 2,660 papers and periodicals from all over the world. Its work is facilitated by the possession of its own post office and its own printing establishment both housed in the same palace which shelters the Institute, which also contains suits of rooms for visiting delegates. Since only governments are eligible as members of the Institute private organizations or societies wishing to correspond with it must do so through their respective governments.

Reconstruction and the Industrial Engineer

WHEN we joined the war against German aggression, two years ago, we realized that we were entering upon a vast manufacturing undertaking, the greatest the world had ever seen. Our men in the field could only win as they were supported by the men back home in the machine shop; the more efficient that support the sooner would victory be achieved and the less precious blood would be shed. Consequently the manufacturers of the country were called together to lend their council in building up the huge industrial organization. The Council of National Defense, thus formed, early awoke to the fact that its membership included no industrial engineers, and also to the fact that there was no national organization of such engineers. An appeal for help was sent to the Western Efficiency Society, one of the most active local societies, which was about to hold its annual convention in Chicago. The response to this appeal was the formation of a national society known as the Society of Industrial Engineers.

The first duty of this society was to aid the Government in the tremendous industrial problems with which it was confronted and its services were of highest importance to the nation.

The Society of Industrial Engineers is meeting next week in New York to study problems that have arisen since the signing of the armistice. There is no doubt that the reconstruction period will make greater demands upon the services of the industrial engineer than even the period of feverish wartime manufacture. During the war the one all important impelling force was production. Everything had to be sacrificed for production and methods were employed which could not be used in time of peace by a commercial concern. Industrial engineers had to adapt themselves to war conditions and modify their systems to conform with unusual circumstances. There was some bungling and some very inefficient work on the part of novices who posed as real industrial engineers. But on the whole the experience was of benefit to all parties. Manufacturers learned to appreciate the services of industrial engineers. They found in them real "coördinators who worked to effect real coöperation between employer and employee. The latter began to lose his distrust of the efficiency engineer and, to understand him better; and the industrial engineer himself learned much about organization and management on the one hand and the necessity of studying the requirements and interests of the individual worker.

On another page we publish an article on Industrial Democracy and Engineering in which these experiences of the war are discussed and the real aims of the industrial engineer are outlined. If his aid was needed during the war his services are even more indispensable today when our industries are going through the trying period of readjustment. The public has been educated to the worth of industrial engineering, and the industrial engineer, himself, has received a most valuable education from his experiences in the war, so that he is better fitted than ever before to aid the employer in the perplexing mechanical and industrial problems which are now confronting him.

To Our Subscribers

OUR subscribers are requested to note the expiration date that appears on the wrappers containing copies of SCIENTIFIC AMERICAN. If they will send in their renewal orders at least two weeks prior to the date of expiration, it will aid us greatly in rendering them efficient service.

Naval and Military

The 14-gun "Agincourt" Not Popular.—The British battleship "Agincourt"—formerly the "Rio de Janeiro" building for Brazil and taken over by the British when the war opened—is notable for the fact that she has no less than seven, two-gun turrets, mounting a total of fourteen 12-inch guns as her main battery. Her protection of nine inches of side armor is reinforced by three protective decks, 17 main bulkheads, and 365 water-tight compartments. The ship, according to *The Engineer*, is a type quite alien to British naval ideas, which run just now to fewer guns of heavier caliber, and in spite of her formidable armament, she is not a very popular ship.

Government to Take Over Cape Cod Canal.—The Secretary of War, the Secretary of the Navy, and the Secretary of Commerce were requested to discuss the advisibility of acquiring the Cape Cod Canal for the Federal Government, and they unanimously concluded that the transfer was desirable. The Secretary of War, after elaborate studies as to the value of the Canal made by the Engineering Corps of the Army, offered the Canal owners the sum of $8,150,000, which they declined to accept. Consequently, the Secretary has asked the Attorney-General to begin condemnation proceedings and report the facts to Congress. It will be agreed that the strategic value of the Canal, providing a practically continuous inside water route from Boston to New York for naval ships, fully justifies its acquisition by the Federal Government.

The Navy and the Merchant Marine.—Discussing the interdependence of the navy and the merchant marine, Vice-Admiral Albert E. Gleaves recently designated the navy as the backbone of our sea power and the merchant marine as its nerves and sinews. He stated his belief that navy and merchant marine seamen should be paid on the same scale, cared for with the same thoroughness, and subjected to the same discipline. In 1914 the total merchant tonnage in the world was about 50,000,000 tons. The war, chiefly through submarine piracy, destroyed 15,000,000 tons, and the new shipping constructed amounted to about 11,000,000 tons, leaving a shortage of 4,000,000 tons. If our program is carried through, we shall have in 1920-21 some 2,000 ships averaging 10,000 tons in individual displacement and totaling 20,000,000 tons. The cost of this fleet is estimated at four billion dollars—10 times as much as the Panama Canal.

Later Particulars of "Hush" Ships.—The latest statement of dimensions regarding the so-called "hush" ships built for the British navy during the war, indicate that their dimensions, speeds, etc., as published during the war were greatly exaggerated. Thus, *The Engineer* gives the following dimensions for the battle-cruisers "Renown" and "Repulse": Length, 794 feet, beam, 90 feet; draft, 30 feet; normal displacement, 26,500 tons: and for the celebrated trio "Furious," "Courageous," and "Glorious," the dimensions given by the same authority are: Length, 786 feet; beam, 81 feet; normal draft, 25 feet; and displacement, 18,600 tons. After the "Furious" was changed to a seaplane carrier, airplanes had no difficulty in landing on her deck after returning from a flight. She is credited with 18 torpedo tubes and with 90,000 horse-power for a speed of 31 knots, which, we are told, was very greatly exceeded in actual service.

Listing Ships for Range.— In the annual report of the Bureau of Ordnance, Admiral Earle states that the turret machinery on the "Mississippi" has been tested and successfully fired, with the ship listed 7½ degrees, which, with the guns at their maximum elevation of 15 degrees, gave the calculated range. This increase of range by listing the ship has been practised successfully by allied ships in various engagements of the war, and particularly in the long-range bombardment of the German fortifications at Zeebrugge and Ostend. We understand that in our latest turret designs the mounts are arranged to give a maximum elevation of 30 degrees, which of course, in any but very exceptional circumstances, would obviate the necessity for listing the ship. It is gratifying to learn that the type, 16-inch, 50-caliber naval gun has, in test, "proved successful beyond expectation, and this gun promises to be an exceptionally splendid piece of ordnance." It will form the main armament of our future capital ships.

Electricity

Wireless Between Great Britain and Australia.—*The Daily Mail* reports that on September 22d last, direct wireless communication between Great Britain and Australia was established, when two messages from the Premier and from Sir Joseph Cook were received by the Amalgamated Wireless Company of Australasia from the new station at Carnar. It is stated that the messages received at Sydney were perfectly clear and distinct, despite direct transmission over 12,000 miles.

Heating Rivets Electrically.—With the employment of women in many forms of work heretofore considered too heavy for them, it has been necessary to modify the equipment and form of work in numerous instances. Such a case is the heating of rivets by electricity in charge of women. Instead of portable, sooty forges operated by turning a heavy crank, there has been introduced an electrically-heated forge which is clean, simple to operate, and readily portable. It will heat a standard rivet in 30 seconds.

A New Form of Variable Electric Resistance.—A recent German patent taken out by L. Strasser relates to a modification of the type of resistance in which an iron enclosed in hydrogen is surrounded by a heating coil. As is well known, a small change in the current flowing through the heating coil can be made to cause a very considerable change of resistance in the iron, and such resistances are claimed to have special applications for use with machines of very variable speed. The novelty embodied in the patent consists in making the heating coil of a material with a negative temperature coefficient. In this way, it is pointed out, the heating coil can be caused to bring about a much greater change in the iron wire resistance, and the sensitiveness of the apparatus is accordingly increased.

Simple Resistance Units.—To a British firm goes the credit for introducing a very simple type of resistance unit which possesses numerous and important advantages. The wire or strip member is supported on a single rod passing through the center section of each leg of the zigzagged wire or strip. Among the special advantages claimed are: Very large radiating surface for a given capacity; small weight for a given capacity; absolute freedom for expansion; owing to the large surface and small bulk of metal they cool very quickly; they are absolutely unaffected by vibration or jolts; units can be run red hot without danger of sagging; repairs can be effected on separate units; tapping can be taken off anywhere along the center clamp; the number of units being small compared with a grid resistance of equal capacity, there are not many joints to cause trouble.

Electric Welding with Covered Electrodes.—According to E. G. Rigby, speaking before the Engineers' Club of Philadelphia, welds made by plain iron or carbon rods as electrodes are frequently deteriorated by pitting and oxidation, resulting in brittleness and porosity and breaking up of the metallic structure. Oxidation renders a joint peculiarly liable to corrosion, which in shipbuilding work is of the highest importance. In the covered electrode process the electrodes are surrounded by a covering of blue asbestos yarn which in fusing acts as a reducing agent, and by excluding the atmosphere from the fused metal effectually prevents oxidation of the deposited metal. The yarn is coated with silicate of Na, Al, or the like to vary the fusing temperature of the asbestos yarn. The electrode, further, has combined with it a small quantity of metal capable of exerting a strong reducing action, such as Al, in the form of a fine wire incorporated in the covering. In operation the arc is formed by touching the work with the end of the electrode held vertically, after which the electrode, still in contact with the work, is dropped to an angle, when the arc is immediately destroyed, owing to the covering passing into the igneous state. The action once started, the electrode melts at a uniform rate so long as it remains in contact, and leaves a seam of metal perfectly diffused into the work, the covering material forming a slag which floats and spreads over the surface of the weld as it is made. Steel plates or castings can be readily cut by dipping the electrode in water and with a relatively high current applying the point of the electrode to the piece to be cut and moving it quickly up and down through the thickness of the plate, allowing the molten metal to drop.

Aeronautical

The German Air Service.—The Paris newspaper *Excelsior*, in an article on German aviation, states that on July 1st of the present year Germany's air force included: 1,530 chaser machines, 300 protecting biplanes, 1,020 reconnaissance machines, and 156 bombers. The latter category included 12 "giants." Germany lost 500 machines between July 13th and November 11th, and delivered 1,700 under the terms of the armistice, leaving only 800 machines, mostly observation and range-finding aircraft. This state of affairs, says the *Excelsior*, effectually prevents any thought of aggression from the air.

Bleriot's Commercial Planes.—From our British contemporary *Flight*, we learn that the Bleriot works are also interested in commercial aviation; so much so, in fact, that two new four-engined airplanes of large dimensions are now nearing completion. These machines, it is reported, will be especially suited to aerial transport in the French colonies, where roads are none too good and railways non-existent. In such cases the airplane will link up by postal air service one colony with another, and with the capital, while numerous other spheres will doubtless be found, in which the large weight-carrying airplane will be of inestimable value.

Waterproofing Airplane Propellers with Aluminum Leaf.—A waterproof coating for airplane propellers, which incorporates thin aluminum leaf in the finish, was developed by the Forest Products Laboratory at Madison, Wis., and placed in production by the War Department. The process is practically 100 per cent effective in preventing absorption of water, particularly in the storage stage. A French authority states that 80 per cent of the French propellers produced are rejected by the pilots mainly because they are out of balance. This difficulty is due largely to unequal absorption or distribution of moisture and can be greatly reduced by an effective waterproofing coating.

A Giant Farman Machine.—The possibilities of post-war commercial aviation are being realized in all the leading countries. It is reported that a new commercial airplane has just made its appearance at the Farman works at Boulogne-sur-Seine. The new machine, which has been christened the "Goliath," has made its official flights, piloted by Bossutreau. It is of the F. 60 type, and is capable of carrying 20 passengers. It is said to have a speed of 160 kilometers (about 100 miles) an hour, and is able to make a continuous journey of 3,000 kilometers (about 1,865 miles). Fitted with floats the "Goliath" is expected to be able to undertake the trans-Atlantic journey. For a start the new machine will probably be employed on a Paris-London passenger air route.

The British Air Force.—At the close of the war Great Britain led all nations in the air. The British air force fought on more fronts than any other nation, and its successes were therefore proportionately greater. In August, 1914, the British naval and military air service together mustered only 285 officers and 1,853 men of other ranks. In November, 1918, there were 30,000 officers and 264,000 men. At the outbreak of the war Great Britain had 166 airplanes, 45 seaplanes, and seven airships, while at the close of hostilities she had 21,000 airplanes, 1,300 seaplanes, and 103 airships. Besides, there were 25,000 airplanes and seaplanes being built and 55,000 airplane engines under contract. The Women's Royal Air Force, which was not in existence in 1914, numbered at the close of hostilities 23,000.

Testing Methods Which Preclude Accidents.—On account of the difficulty in securing suitable pieces for the manufacture of larger airplane parts and the necessity of conserving material, several series of tests were conducted at the Forest Products Laboratory at Madison, Wis., on built up beams and struts of various designs and also various types of splices. Results of these tests were used in preparing Army and Navy specifications for laminated and spliced beams and laminated struts. Two simple non-injurious methods for determining the strength of struts have been developed and further tested for inspection work, which it is thought will considerably reduce the number of rejections under the standard method. The tests are made on full-sized specimens every strut used being subjected to the standard test which is more severe than any working load could possibly be.

The North Sea Mine Barrage—I

Closing the North Sea With a Wall of Mines, 230 Miles Long by 25 Wide—The Preparatory Work

By Captain Reginald R. Belknap, U. S. N., Commander of the U. S. Minelaying Squadron

U. S. Minelaying Squadron at Sea, en route to the great minefield, North Sea, September, 1918

"SORRY not to be able to say good-bye personally to all your good fellows who have done such excellent work"—was the Christmas message from Rear-Admiral Clinton-Baker, R. N., head of the British mining service which coöperated with ours in laying the great minefield barrier against submarines, stretching from the Orkney Islands to Norway. And in Admiral Sims' address, just before the American Minelaying Squadron left Portland, England, for home, he said, "After we came into the war we designed a mine, built it, equipped the mine layers, sent them over to this side, and planted more mines in less space of time than any nation in the world ever thought of doing before—one of the finest stunts the Navy has accomplished on this side."

Reducing a new invention to practice in a few months is no small problem, especially when it is a mine to be planted much deeper, and over bottom 100-fathoms deeper, than ever before—yet this had to be done, to meet the enemy's submarine campaign, the most serious menace to the cause of America and the Allies. Along with hastening our destroyers into the war zone, our Navy Department advocated other active measures, essentially offensive, to block up the German bases.

Towards such an end British destroyers had been constantly planting mines near the German coast, but they could not prevent the enemy from sweeping channels through. Besides, since the Skagerrack could not be closed locally without violating the neutral waters of Denmark and Norway, the situation needed a barrier which would include the Skagerrack, and also be too far from the German bases for surprise in force. If only half successful such a barrier would still be more effective against submarines than merely hunting them at large. Yet it called for such numbers of mines, to provide and plant in a short time, as to make the undertaking appear impossible.

Among the countless war inventions pouring into the Naval Bureau of Ordnance upon our joining the war, was one which, unsuitable in its original form, contained a device that was adaptable to the firing mechanism of a mine, with great possibilities if so applied, especially against submarines. The peculiar virtues of the new mine were extreme sensitiveness and twice the reach of any other mine—both qualities invaluable. The result was, briefly, that the Bureau of Ordnance could, in July, 1917, assure our naval authorities that, in urging the closing of the North Sea, they might at the same time offer the means for its accomplishment.

To convert the skeptical into ardent advocates of the new mine, to develop and test some of its features, to outline plans and settle preliminaries, all took time, but on October 29th, 1917, the order was given to proceed. The terms "impossible" and "foolish" were freely applied to the scheme. Contracts for 100,000 mines would have to be let, and tens of millions more spent outright, both here and in Great Britain, based on test of the mine only by parts, since a complete new mine did not yet exist. But in spite of the several elements of uncertainty, the undertaking had the unqualified approval of everyone in authority, from the President down.

Briefly, the project was for the United States and British mining forces to coöperate in establishing a minefield barrier across the North Sea between Scotland and Norway. The minefield would measure 230 miles long by 25 miles average width, consist of 70,000 mines, in "systems," each comprising one or more lines of mines near the surface, other mines deeper, and yet more, deeper still, so as to bar or imperil the passing of any vessel, whether on the surface or submerged.

Bases for assembling the American mines were to be prepared in Scotland, at Inverness and at Invergordon, 20 miles distant, on Moray Firth, above Aberdeen. Considerations of navigation, of shorter exposure to submarines, and of saving the carriers' time, dictated the decision to unload all cargoes of mine material from America at the western terminus of the Caledonian Canal, and at Kyle of Loch Alsh, opposite the Isle of Skye. The cargoes would be transported across Scotland by canal motor barges and the Highland Railway. Limited capacity of these transportation routes necessitated having two assembling bases for our Mine Squadron instead of one. These bases were constructed by the British Admiralty, Captain O. G. Murfin, U. S. N., being the supervisor on our part and in charge of the bases when completed. Most of their machine tools, furnishings, and other equipment were sent from the United States.

Secrecy, as well as haste, necessitated dividing the construction of the mine among 500 contractors and subcontractors. Parts manufactured in different places were sent to a third place for joining, and all were finally sent to Norfolk, Va., whence they were shipped to Scotland, where the mines would be assembled complete for the first time, ready for planting. The mine spheres were charged with high explosive at a plant near Norfolk, containing large steam kettles, which poured 300 pounds of molten TNT into each sphere. In this quiet corner the sailors worked in constant danger from fire and the poisonous fumes of the molten explosive. Several were seriously overcome and one died from the effects, but the rest stuck to it through the long, hot summer months.

To carry the mine material over, small steamers were chosen, to minimize the effect on the operation in case of loss. One, the "Lake Moor," was sunk by a submarine in April, with 41 of her crew, making almost the only loss of life in the whole operation. They had capacity of 2,000 to 3,000 tons and carried 1,200 to 1,800 mines, besides stores of various kinds. Our minelaying squadron and bases were supplied almost entirely from America obtaining abroad little more than fuel, fresh meat and vegetables. There were 24 of these carrier steamers constantly employed, from February on, two or three sailings every eight days, all under the management of the Naval Overseas Transport Service.

Towards making up a squadron large enough to undertake the barrier, we had the old cruisers "San Francisco" and "Baltimore," converted into minelayers in 1911 and 1915. In excellent condition in spite of their 28 years, and well prepared by two years' training and development in mining, they made an invaluable nucleus; but their combined capacity of 350 mines needed large augmentation. The manufacturing output was soon to be 1,000 mines a day, and the round trip for one minelaying operation could be estimated at not less than five days—coaling, embarking mines, out and back, ready for the next operation. Hence, a squadron with a capacity of 5,000 mines would be needed to keep up with the supply and thus plant the barrier as soon as possible.

Eight merchant steamers were converted to carry mines on one, two, or three decks, making, with the original two, 5,700 mines capacity, thus providing a good margin for contingencies. Mines are carried on tracks of steel channel bar, placed with the flanges inward. The small wheels on the box-like mine anchor tread on the lower flange, while the upper flange serves as a check against the mines' upsetting in

Transferring mines from trucks to barges

heavy rolling at sea. The mine spheres are secured fast on the anchors, so that mine and anchor go overboard together, the release of the anchor taking place after they reach the water.

In our largest vessels, there were two long tracks on each side of the launching deck, which was the first covered deck; the same on the next deck lower, with shorter tracks in between at the ends; and similarly more below. On each deck there were several cross tracks, with a simple form of turntable at each intersection, for convenience in loading the ship and to provide alternative routes for getting the mines out in case of a jamb.

Two launching ports, about 10 feet above water, were cut through the stern, one on either side of the rudder head, and about 20 feet of single track led, from each port, forward, to a switch connecting with either of the two long tracks. Steam winches were installed on all decks to haul the mines along, in trains or "fleets" of 30 to 40. Each mine with its anchor weighs 1,400 pounds and as its wheels are small, it takes power to give the long trackful of mines the slow, steady movement towards the stern which is necessary to make the planting interval between successive mines uniform.

At the stern, just inside the launching ports, were mine "traps," which held one mine at a time on a slope. Outboard, projecting about three feet beyond the ship's skin plating, the mine track curved downward, ending at 45 degrees. Upon throwing the trap lever, the after jaws would open and the mine, of its own weight, would run down the slope, over the curved "quadrant," and dive overboard. At the same time, the trap's forward jaws would close, preventing more than one mine slipping through at one opening. The mine track near the trap was higher than the rest, the up-grade serving to check the mine's surging sternwards while mining in a head sea.

Control throughout the mine decks was effected by an electrical system of signal lights and gongs. At a central point, near the launching ports, the mining officer could communicate with the captain on the bridge, by telegraph indicator and voice tube, and could signal to stop, start, or reverse any winch. Stations were provided along the tracks, so that sentries, in case of a jam or anything wrong, could signal to stop the winch concerned, and also to "walk back," or "all clear" again.

To enable the entire load of a ship to be planted in one continuous string, elevators were installed in the forward part of the ships, so that, as the mines on the launching deck moved sternward, those on the lower decks could be hauled forward to the elevators and sent up, to be planted in their turn. The elevators were hydraulic or electric, six in four ships, four in two others. All were the Otis Company's standard platform type, each lifting two mines at a time, in 20 seconds the round trip. The transfer capacity between decks was ample for the maximum rate of mine planting, even if half the elevators should become disabled, but during seven months in all kinds of weather, of 32 elevators, only one failed—once.

The experience of the British with elevators had not been encouraging and there were other points where we took a new departure and succeeded. They had trouble from the tracks closing or opening with the working of the ship in a seaway, thus binding the mines or allowing them to drop between tracks and jamb. Our design, of a steel cross-tie mounted on a wooden bolster, obviated any such trouble, although our tracks were of much lighter section than theirs. Then there was the question of switches. Some one suggested a parallel motion, pivoting each switch rail at the single-track end, which made our switches incredibly simple and effective. The aim throughout was to make the mining installations substantial enough to endure hard usage, yet simple; to provide power where power was needed, including ample reserve for temporary disablement. Experience in our Mine Force during the preceding three years had taught that alertness, intelligence, and judgment of trained mine crews made the best dependence, and that, where kinky, springy, wire rope and heavy, lumbering mine weights were concerned, automatic or complicated devices were dangerous.

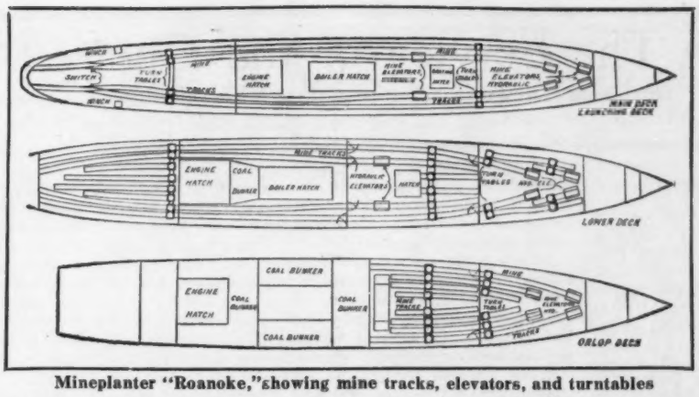
In brief, the mining installation and organization provided for a well regulated movement of the whole mass of mines, in such a way that the ship's trim was preserved as long as possible, while the planting went on without interruption. The plans, workmanship, and training were so good that, on the first operation, the "Housatonic" planted 675 mines at 11½ seconds interval, without a break, and on a later occasion the "Canonicus" planted a string of 860 mines, 43 miles long, one every 15 seconds in 3 hours and 35 minutes.

The minelayers' other arrangements were very good though ventilation was scant, for lack of sufficient blowers while fitting out. The batteries were small, one five-inch and two three-inch anti-aircraft guns in each ship, except "San Francisco" and "Baltimore," which had four 5-inch guns. Guns were in great demand elsewhere while our ships were fitting out, and for structural reasons also it was necessary to limit their armament to anti-submarine defense. It was contemplated that the squadron would always be escorted by destroyers and be supported against surface raids.

With mines filling so much of the living deck space, the crews were very crowded most of the time. Mines were constantly at one's elbow, horns and sharp corners ever ready to tear one's clothes, and everywhere were mine tracks, half-knee high, or turntables, to trip the unwary. But no complaints, good humor always. One ship's joke demands a wound chevron for every calloused shin. The officers and men felt intense pride and interest in their ships, and spared no effort to keep them in regular man-of-war condition. The 10 American ships made a handsome squadron, and the British officers, as well as our own, openly expressed their admiration.

In capacity for carrying mines, equipment for handling and planting them continuously, and general arrangement and quality, the American minelayers were admittedly superior to any others.

(To be continued)



Mineplanter "Roanoke," showing mine tracks, elevators, and turntables

The North Sea barrage containing 70,000 mines

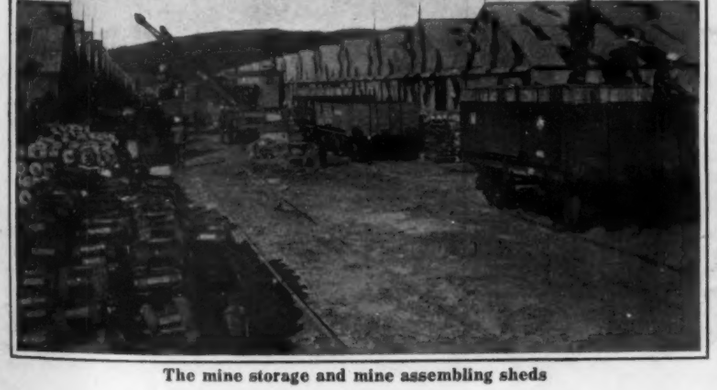
Fluorescent Fluids

PROF. JEAN PERRIN, Head of the Department of Chemistry in the University of Paris, has just published the preliminary data and conclusions in connection with investigations which he has been making of the phenomenon of the fluorescence of fluids. These investigations were begun some time ago, but interrupted by the war; and it is not only now that Professor Perrin has felt his thesis to be in such shape as to render publication possible.

The investigator has started with the idea that fluorescence is in some way a phenomenon of the molecule; and with this idea, he has prepared glass slides with the object of spreading out his fluorescent solutions to ultramicroscopic thickness. The immediate results of this procedure are to make it clear that fluorescence involves the destruction of the fluorescent body—not a reversible reaction, which would make it possible for the fluorescent substance to regain its luminous powers after a period of "rest," but something in the nature of polymerization, to mention one possible explanation advanced by Professor Perrin. Indeed, he feels impelled to suggest that perhaps the molecule is fluorescent only at the very instant of its destruction, so that in the most literal sense we have a phenomenon of physical disruption.

An interesting point brought out by Professor Perrin is that temperature and viscosity appear to exert no influence upon fluorescent powers. He even went so far as to compare results obtained at ordinary temperature and at that of liquid air, with negative results so far as appreciable difference was concerned.

There is a good deal of analogy between the results obtained by the investigator, and the known facts of fluorescence of solid bodies, although Professor Perrin is careful to keep the two cases distinct. On the whole, the discussion, as translated in this week's SCIENTIFIC SUPPLEMENT, is a most interesting one.



The mine storage and mine assembling sheds

Trainload of mines on way to the quay

The Service of the Chemist

A Department Devoted to Progress in the Field of Applied Chemistry

Conducted by H. E. HOWE, Chemical Engineer

Colloids at Work

GRAHAM discovered that if parchment or parchment paper is stretched over a frame to make a diaphragm, that such a diaphragm or membrane will separate substances into two great classes: Those which can pass through in solution and those which can not or only do so with great difficulty. The substances which can pass are usually capable of being crystallized while the others are jelly-like and their solutions have properties which differ markedly from solutions of well known crystals. A favorite experiment is to place a solution of salt and of glue in a membrane on the other side of which water flows slowly. The salt passes through into the water and soon the glue only is to be found in the membrane covered cell.

This principle has been applied commercially in several industries and is variously styled dialysis, diffusion, osmosis, etc. Some crystalline substances diffuse more rapidly than others so that certain separations can be made between crystalloids as they were originally called. Sometimes the vegetable cell itself becomes the membrane through which sugar, for example, is extracted by treating the sliced beet, in this instance, with successive changes of water. The temperature is made such that the albumins are first coagulated in the cell walls thus facilitating the passage of the sugar solution and then eight or more changes of water are brought into contact with the pencil-size V-shaped slices upon the counter current principle. This allows fresh water to take the last of the sugar (all but about 0.5 per cent for it is not economical to carry the extraction below that figure) from the nearly exhausted pulp and the juice of highest sugar content to be drawn from the first cell for purification.

In the beet sugar industry we also find an example of osmosis using a membrane. A point is reached in crystallizing out the sugar when even impure crystals cannot be won from the residual molasses. This molasses contains above 50 per cent of sucrose and is unlike molasses from cane in being unsuited for human use. The sugar is recovered by precipitation with strontium or lime or by osmosis. In the latter method the diluted molasses passes slowly along one side of a series of membranes and water flows in the opposite direction on the other side. A large percentage of the sugar passes through.

Within comparatively recent years colloids have been studied more intently and much work has been done in an effort to learn more of what actually takes place in reactions involving them. Their aqueous solutions when pure have the same boiling and freezing points as the solvents themselves so the conclusion is that they are not true solutions but excessively fine particles in suspension. These particles pass through the finest filter papers and some are too small to be seen under the microscope. The ultra microscope enables some studies to be carried on through the observation of the shadows cast by the particles and light reflected by them. Colloidal gold is responsible for the beautiful ruby glass and colloidal copper was used for red signal glass until chemistry pointed the way for the employment of selenium to produce that color.

There are many who grow impatient awaiting some practical results from academic research which seems at times to move with the speed of a glacier and yet progress is not made without such research. How often curative medicine has been compelled to wait until a way of communicating the disease under investigation to lower animals for study could be devised! We know now how to prepare colloidal suspensions and that will lead to many commercial applications. At least two may be mentioned as accomplished and one of these has been developed as a result of the war.

The importance of a concentrated, easily handled, efficient fuel for war and merchant vessels is obvious and in times of emergency when speed and space count for most this importance is greater than ever. A colloidal chemist conceived the idea of fortifying fuel oil with colloidal coal so fine and in such a physical condition that it would be permanently in suspension, go where the oil would and pass through the small orifices of valves and burners without clogging them. Experiments showed the idea to be sound and its further development will be an efficiency and conservation measure.

The extensive use of metal automobile bodies introduced a problem in lacquering and enamelling for, in order to get the required hardness and durability in the finish, it must be baked. Eventually electric ovens of great size were installed and all went well until, in an effort to economize in the use of current, the ventilators would be closed or partly closed with the result that highly inflammable vapors from the lacquer and enamel volatile solvents collected in dangerous quantities in the ovens. There were fires and wild explosions, loss of work and disturbed schedules.

This condition affected the oven manufacturers more than the enamel makers and one of those making electric heating and controlling devices for ovens instituted research not on the apparatus but upon an enamel minus the expensive and troublesome volatile solvents. The problem has been solved and the same covering materials—gums, pigments, etc., may now be had in colloidal form in water. They cover well, bake without any material variation from the usual methods of treatment and when once on the metal the result is the same. The ovens may be operated to suit for there is no danger. The element of safety and freedom from property loss have been secured without increased cost, if indeed not without an actual saving in the expense of enamels.

And then because the gums are in suspension and not in solution there is nothing to make small pieces stick together. They may be put into a wire basket, dipped into the colloidal lacquer and baked without being removed and given the individual attention necessary with other lacquers. If the metal can be heated slightly before dipping, a still better job can be obtained. There are no "fat edges" and no marks of adhering to other pieces. Such lacquers or enamels may also be brushed on or sprayed as desired.

These developments are real steps forward and further achievements along these lines may be expected. Colloidal chemistry and physical chemistry, theoretical though they may seem, are accomplishing great things for industry and when we begin to graduate chemical enginers well grounded in these new divisions of chemistry, still greater things may be expected.

The Reporters' Chemistry

A GROUP of educators who were discussing the courses which a chemical engineer should take in order to be all that the title might be said to imply finally included nearly all the engineering and applied science available in addition to a few years spent in obtaining a broad foundation in general subjects. They left but a few years for practice after graduation in the span of a normal life when all the suggestions had been combined! And so also a reporter must specialize or spend most of his years in preparation. The articles one sees occasionally, surely convince us that too often science is omitted from the reporter's curriculum.

The recently reported "explosion" of a molasses tank is an example of what headlines can do and how often "the story" is more dear to the reporter than the more exact but somewhat less spectacular facts. Things lose their "news" value if investigations are awaited or time taken to get an authoritative opinion.

In one of our largest cities a steel tank had been erected in which to store molasses used in producing industrial alcohol. The tank was of great capacity and was near the water front so that vessels could pump their cargo into storage and hurry away for another load while the tank's contents fed the distillery with raw material. One day things suddenly gave way and there was a loss of a number of lives besides some property damage. The daily press seized eagerly upon "explosion" as an appropriate word to describe what had happened and detailed the geysers of molasses thrown high in air to descend with vast destruction on the vicinity. All this was supposed to be the result of fermentation and when it was found that 600,000 gallons of fresh molasses had just been pumped in those adhering to the theory explained that this formed a seal over the older stock and helped to confine the gas. With the molasses entering through a pipe in the bottom of the tank it is difficult to see how thorough mixing could be avoided.

It has also been suggested that the warmer new molasses cooled so rapidly as to cause contraction sufficient to rupture the tank. The opposite has also been advanced, namely, that the old stock became suddenly warmed up by the cargo fresh from the tropics and just naturally pushed the walls out! In all these arguments the rate of heat transmission seems to have been forgotten as well as the possibility of expansion and contraction vertically in the tank as well as horizontally.

Fermentation is a very powerful agency but exerts this power just as powder does, *only when confined*. Thus the "springers" in the canning industry are caused by the pressure of gas within the can resulting from fermentation. The tin can usually withstands this pressure but glass ones have "blown up." But even a small vent will carry away the gas as formed and this tank had a gooseneck vent-pipe about five inches in diameter. Then there were manholes, the doors of which remained closed only by their own weight and one was open ready for gaging.

Besides, the tank roof was intended merely to keep out the weather and this light roof would have been destroyed rather than the walls. Yet when examinations were made the roof was found intact on the ground where the subsiding flood had left it. It seems reasonable to have expected such a roof to function in the same manner as do light weight roofs in powder mills where they serve to vent any explosion upward. No one seems to have heard an explosion.

There have been a number of experts to examine the wreck and the only published report, that of the grand jury, disclaims the explosion theory. Then how explain the catastrophe? Mechanical failure at some local point following the cumulative effect of repeated stresses and there is remote possibility that a few rivets may have been weakened through the gradual and weak attack of acids occasionally present. Molasses, being of high specific gravity, would soon widen a small breach especially with such a pressure as the quantity present could exert. A 15-foot tidal wave of heavy molasses carrying broken steel plates might easily wreck fabricated steel columns designed only for vertical loads and a person caught in it could escape only with great difficulty.

"Slow as molasses in January!" One policeman standing not far from the tank when the flood came just did manage to reach the corner first and turn as the stream rushed by while a motorman with an empty street car stopped his car when he saw what was coming and tried to run out the back door. He was too slow and had to climb on top and await rescue.

The forces of nature are all powerful but they work according to natural laws.

Made-to-order Gravel

THE majority of contractors have to take gravel as they find it and geologists tell us it was a long time in the making. It seems that it may no longer be necessary to wait for nature to form gravel from clay but that it may be made when and where wanted and the method is described in a recent number of the "Little Journal."

It seems that there was no gravel suitable for an aggregate in concrete to be found near the location of a southern shipyard where concrete ships were to be built. The question was answerable in three ways: Move the yard to gravel, haul in the gravel over congested railways or make the gravel from local clays. Fortunately the clays were found to possess the necessary characteristics to enable them to be burned to hard, though porous, lumps and a second series of experiments showed that when the rate and temperature of burning were controlled it was possible to produce lumps of the desired size.

This firing was easily done in a rotary cement kiln and when the concrete was finished it was found to pass the strength tests and to be nearly as strong as any other concrete. Then it was demonstrated to have unusual buoyancy and that meant that a given number of tons of such concrete made into a vessel would carry more tons of cargo than wooden vessels of the same rating, more than the ordinary concrete and almost as many as the steel vessels.

The incident is strikingly illustrative of the old saying that necessity is the mother of invention and shows how science in finding a substitute for a specific purpose sometimes improves on old materials.

Substitutes for Hickory Handles

SPECIFICATIONS for handles for intrenching tools were prepared during the war by the Forest Products Laboratory at Madison, Wis., allowing seven substitute species in place of hickory and also permitting certain minor defects which have heretofore been ruled out. This made possible greatly increased production for this class of material and at the same time gave satisfactory handles.

Industrial Democracy and Engineering

Some Lessons That Have Come Out of the War

By Irving A. Berndt, Secretary of the Society of Industrial Engineers

CIVILIZATION, ever progressive, is completing its latest great step forward and after monumental effort, almost inhuman sacrifices and a stupendous massing of resources, we are promised a great world democracy.

Even before the culmination of this advance, and seemingly as an outgrowth of the very program and conditions which have made this step possible, this same insatiable civilization is making a new demand for advancement. It is from all indications now insisting that we must have not only a great political world democracy, but a great industrial democracy as well.

The great war was proven that not only must the old political regime be changed and readjusted, but a reconsideration of the industrial and economic plan must follow and if possible go hand in hand. The great world leaders and the best minds are coming to a thorough appreciation of the fact that workers and producers of the civilized population of the globe, besides being governed politically along the broadest kind of democratic lines, must also be allowed to produce under a similar plan and set of principles. Does this not spell an industrial democracy in every sense of the word?

Here it might be interesting to consider for a minute what steps have led up to this new development. It has been especially interesting to study it in America and to see, sometimes gradually, sometimes slowly and sometimes over night, the marked changes which have come over our industrial viewpoints and attitudes. Experience has been doing its bit for us in this country during the war. Many things has it taught, and especially as regards the industrial activity necessary for the victory we won, has it given us lesson after lesson. Then, too, these lessons have been generously apportioned, not only to the government, administration and managment, but to each individual worker as well.

Let us consider some of the very well-known features which, coming out of our war production requirements, are here to stay. Broadly, these can be classified under two headings. First, those dealing with the principles and plan of organization and management control and, second, those which have to do with the personnel and individual worker under the plan.

In the first classification those principles most popularly accepted are probably as follows:

(a) A plan for proper functionalization of responsibilities.
(b) A plan for centralization of control and management of each function.
(c) The application of expert knowledge to each of the various problems.
(d) The use of the trained mind and the development of a plan of more intensive training for this purpose.
(e) A plan under which definite programs of all activities are preplanned.
(f) A most intensive plan of specialization.
(g) A plan for producing absolutely on a basis of quantity production.

Under the second class, those having to do with the personnel or individual, we find a new acceptance of the following features:

(a) The proper selection of men for each job.
(b) A carefully worked out plan of proper distribution and assignment.
(c) A well defined and standardized method of intensive training.
(d) An adequate provision for satisfactory conditions of work and activity.

It seems hardly necessary to look back and justify the acceptance of each one of these features. Suffice it to say that they have all been used and found not only valuable but really essential, and for each there are specific applications available for further analysis and of such great and well-known magnitude as to prove beyond all question their effectiveness. For instance, the proven success of the Selective Service Draft, without which our armies would probably still be in bloody combat, is an example of not only all the features itemized under the second class, but many others as well.

And from all this has come two big realizations, so big, in fact, and so fundamental, as to make them, we believe, a possible keystone for that Industrial Democracy for which there seems to be such persistent and continuous demand. Both are so equally important that it is extremely difficult to know which to set forth first. They should not be considered separately or in any order, but rather in conjunction.

The one is the realization by the mass, including all of us, as workers, producers, or traders, of the need for proper leadership and control, and a leadership based not on wealth, social distinction or political power, but one coming from proven ability and experience as well as the necessary training and education. The other is the realization by these accepted leaders and directors that at the very base of every problem of management and control is the human factor and, hence, there must be as a part of this leadership a sincere appreciation on their part of the problems and viewpoints of our workers, and a real desire not only to study their requirements but, in complete coöperation, to fulfill them.

The writer sincerely believes these two visions have come and, despite the scattered outbreaks of strikes and industrial unrest, is entirely optimistic of the outcome because of a complete confidence in the higher intelligence of average American people who with such visions will live up to them. Nor have these new convictions come alone to those in this country. On the battlefields of France we believe all of our soldiers have had a similar experience and when they all return, we shall find that the men in the ranks have learned to respect able leadership and that our American Army officers will have learned to respect and appreciate human relationships. These men will be a big factor in our industrial readjustments.

Returning to the question of definite industrial

(Continued on page 264)

Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

"Delenda est Carthago!"

To the Editor of the SCIENTIFIC AMERICAN:

"*Delenda est Carthago*" was the demand which Cato, the old Roman senator, appended to his every speech in the senate of Rome, year after year, until finally that demand was satisfied. Oh for a greater Lodge who should have arisen years ago in our senate to exclaim as a part of his every speech: "*Delenda est Germania!*"

Germany must be destroyed. It has forfeited its right to existence as a political entity. During the 50 years of that existence its sole *raison d'etre* has been conquest and domination, political and commercial. It has been a constant center of plotting, scheming and threatening, terrorizing the rest of the world from England to China and compelling a worldwide burden of armament which, without it, would not have existed. Prussia is, both by size and aggressiveness, the boss of the combination, and likewise the engineer and builder of that gigantic Camorra known as the German Empire; first compelling by threats the North German states to form the North German Confederation, then bringing in by the same force and terror Bavaria and the south. But even without Prussia the inherent German bent toward "conquering the world"—shown long since in the Hansa league—is too serious a matter to be allowed to pursue its further way unmolested out of mere sentimentalism.

Germany will probably, after this war, disintegrate of its own accord. But if it does not, that should be one of the terms of peace. The peace of the rest of the world demands the dissolution of the German trust into its component states, even as that of our country demanded the dissolution of our trusts.

It would be a true calamity if, after all the world has suffered, Prussia should still be allowed to continue to dominate the other states. Prussia must be isolated, and kept isolated henceforward. And let us remember that Prussia lies entirely east of Berlin. "Rhenish Prussia" is no part of Prussia proper, being detached from it and constituting merely that territory which the Prussian kings, by hook, crook, conquest, thievery royal dickering, chicancery or whatnot, have come by since Prussia started out to be a "Weltmacht." Take away this rich mineral, agricultural and manufacturing district, sending the Prussians back to their fens and fogs on the shores of the Baltic, and you will have drawn the teeth and claws of the tiger beyond possibility of regeneration. Then, and only then, shall we have a peace that ceases to demand our eternal vigilance and preparation for war. Let them be flanked, as at the beginning, on one side by the Letts and on the other two by the Poles, and it is a safe guess that they will not have much chance in future of expanding at the expense of their neighbors, threatening other states and countries, acquiring colonies in the Pacific, or turning the Baltic into a "German lake."

When will our politicians begin to understand it? "*Delenda est Germania!*"

GEORGE W. COLLES.

Rosharon, Texas.

The Ideal Shoe

To the Editor of the SCIENTIFIC AMERICAN:

From the beginning of the world, shoes have been more or less complicated things, but have had always an elaborated process of construction. Think that the scientifically designed shoe does not exist yet; I mean one with a rigid frame only capable of those movements needed by feet. It should be covered by any required material. If any part of the frame or material should be worn out, it could be easily renewed.

FRANCISCO COMPAIRED TRIARTE.

Toledo, Spain.

The Wireless Amateur

To the Editor of the SCIENTIFIC AMERICAN:

I wish to thank you for the publicity you are giving the claims of the amateur wireless operators, as shown in your edition of December 28th, 1918. It would be a great loss to the scientific world and to the nation, if the activities of the amateurs are in any way discouraged or limited. Their work should be encouraged and favored by the Government.

H. A. J. UPHAM.

Milwaukee, Wis.

A Phonetic Alphabet

To the Editor of the SCIENTIFIC AMERICAN:

A recent correspondent of your journal desires a phonetic alphabet. Hundreds of thousands of dollars, have been spent in this country to bring this about, but all without result. I think the public will never adopt one

The Oxford Dictionary employs about a hundred symbols as a phonetic key to its pronunciation of English words; and some phoneticians say that it would require a thousand or more to represent all the sounds of human speech.

There are really but 33 elementary sounds in our language; but our text-book makers will have thirty-seven to forty-five.

EWING SUMMERS.

Washington, D. C.

That Molasses Explosion

To the Editor of the SCIENTIFIC AMERICAN:

I have just been reading in your issue of February 1st, some comments of yours on the recent explosion of a tank of molasses in Boston. That the explosive potentialities of molasses were recognized a long, long time ago is quite evident from the language of an old song of which I send you one verse and the chorus:

Old Dan Tucker come to town
He swallered a hogshead o' 'lasses down
The 'lasses worked and the hogshead bust
And off went Tucker in a thunder-gust.

CHORUS

Out o' the way, old Dan Tucker,
Out o' the way, old Dan Tucker,
Out o' the way, old Dan Tucker,
You're too late to come to supper.

As a poem, no doubt, the foregoing leaves much to be desired. The language is inelegant and the last line of the chorus is certainly a lame and impotent climax following the tragedy of the previous stanza. Nevertheless compared with *vers libre* it is a literary masterpiece. I have known this song since about 1855 and quite possibly it dates from 1775—I do not know. The verb "to work" used to be commonly employed by country people to describe fermentation. Cider, preserves, and molasses, with some other substances "worked" under certain conditions.

F. S. LUTHER.

Hartford, Conn.

Dusting a big boa constrictor with arsenic powder to kill the piraplasmosis parasites

The blotched chicken-snake, which was infected from the feathers of its once-in-forty-days meal

Ticks as Carriers of Animal Disease

Inferences Drawn from the Destruction of 500 Reptiles at the New York Zoological Garden During Several Years

By W. H. Ballou, Sc.D.

DAILY newspapers recently reported that some kind of an epidemic existed among the reptiles at the New York Zoölogical Park. Losses of over fifty snakes daily were ascribed to "cooties," a name given by the British "Tommies" to the trench louse.

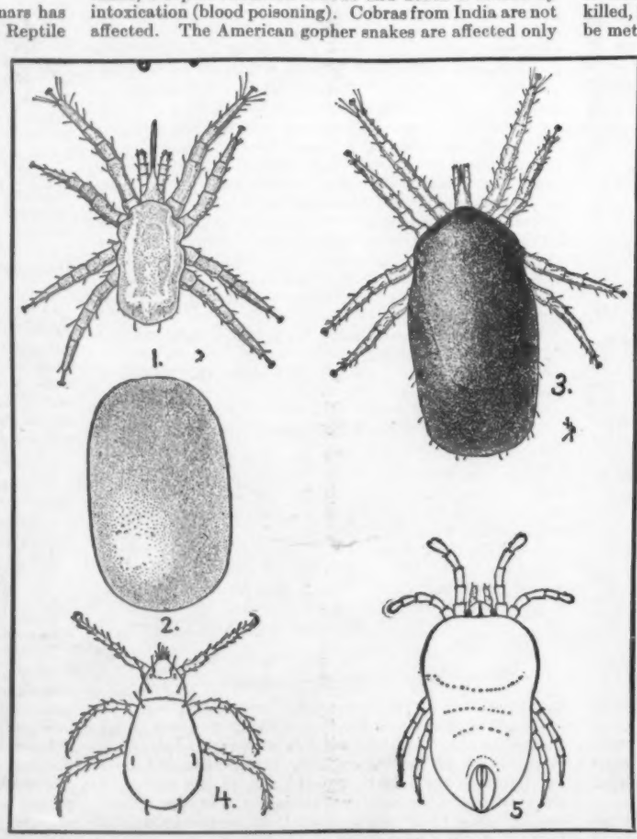
Dr. Raymond L. Ditmars, Curator there of reptiles and author of "Reptiles of the World," admitting to the writer that an epidemic had been raging, denied that it had been caused by "cooties." Incidentally he stated that the carrier of the disease was a tick and that a check on its ravages had been secured by use of a liberal coating of arsenical insect powder on the scales of the snakes, lizards, etc., Over 500 snakes succumbed during the past several years, before the check was discovered.

By this it should be understood that Dr. Ditmars has only succeeded in getting rid of the ticks in the Reptile House, thereby preserving the remaining reptiles. A new consignment of reptiles may at any time reintroduce the epidemic. The dread disease of Piroplasmosis, which annually wipes out millions of dollars' worth of cattle, fowls and domestic animals generally in different parts of this country and the world is according to bacteriologists, the disease which is destroying the snakes. The value of a serum is indicated by Muir and Ritchie in the new revised edition of their "Manual of Bacteriology," when they say:

"With regard to the pathology (science of disease) of infection by Piroplasmata, we know nothing. The diseases are often extremely fatal, carrying off nearly every individual attacked, but we do not know the nature of the changes originated."

Suppose a half dozen Zulus from South Africa where transported and immediately set down in a crowded New York theatre. Close contact would surely result in these Zulus giving off the diseases to which they are immune at home and infecting some or all of the crowd of strangers to which they were introduced. The Zulus in turn might be infected by the germs carried by New Yorkers to which the New Yorkers were immune. Neither of the parties to this meeting would have natural defenses against the diseases of the other. Precisely that is what happened at the Bronx Garden. Some Iguanas (lizards) were received from South America. They bore upon their bodies, ticks from the parasitic disease to which they were immune. The parasite carried by these ticks had never been able to break down the defenses of the iguanas, although constantly irritating them. On arrival at the Bronx Garden, filled with keel-scaled snakes, the ticks scampered off the backs of the iguanas and attacked the defenseless snakes. Immediately there was an epidemic, first among a large group of Australian snakes. Having killed off the entire collection from Australia, the ticks attacked all other snakes, finding easy victims among those with keel, rather than smooth-scaled snakes. The snakes which alone escaped attack were those from South America where the iguanas came from, showing that they too, in their own environment, had acquired immunity.

The keel scale may be described as rough, with a ridge across it, as against a large scale which is smooth. The keel scale affords an opening into which the female tick can thrust down its head and lay its eggs in the blood. Here the young ticks hatch and live a subcutaneous life. A parasite is released from the blood in the tick egg into the blood of the snake, where it breeds with enormous rapidity. The parasites accumulate in the lesions of the snake, a septic condition follows and death is caused by intoxication (blood poisoning). Cobras from India are not affected. The American gopher snakes are affected only around the eyes, which swelled up in some, causing total blindness. The Australian keel-scaled snakes were rapidly swept out of existence—a clean sweep—from blood poisoning. Many other keel-scaled snakes succumbed. Dr. Ditmars observed that snakes in damp cages succumbed most readily. He put them in dust cages with fair results and thereupon evolved the cure. By dusting the snakes with an insect powder containing a small percentage of arsenic, the openings of the scales were closed and the ticks killed. Ticks also caused skin disease, that is, eruptions, or ulcers of the skin, which the use of the powder ended. The powder, penetrating the pores in the skin, naturally reached down, in some cases to the eggs of the ticks, killing them. A sick snake, reached in time, thus had his enemies killed, his ulcers and infection of blood given a chance to be met by the reptile's natural defenses. A cure followed, if the snake was not too far gone before application of the powder.



The ticks that carry piraplasmosis. (1) The female; (2) the egg; (3) the tick after feeding on animal blood; (4), (5) the chigger or tick that attacks humans

A snake, of course, is an extremely nervous animal, and getting him thoroughly powdered is some job. Handlers of snakes have to be careful with affected snakes, as the ticks readily and willingly transfer their operations to humans whose blood they somehow know is far easier to reach. Many types of snakes carry malarial germs but are immune from malaria. When, however, they come in contact with snakes without such immunity, the disease takes hold of the non-immunes. The iguanas and the snakes from the same region of South America are immune from the blood contamination and ulcers caused by parasites borne by ticks. These same iguanas and snakes, however, when introduced to reptiles having malaria or other diseases, get those diseases, having no immunity thereform. Thus is shown plainly how disease may spread among humans and lower animals. It also indicates that we get diseases from which we are not immune by contact with persons or lower animals which have the germs but are immune from them. We leave New York and travel. We get disease in a new locality from persons who are merely carriers of the germs to which they are immune. The strangers we meet get disease by contact with us by acquiring our germs from which we, ourselves, are immune. These matters which have been proved by the universal war on disease ought to impress our health authorities with the fact that mere quarantines are not enough to wholly stop the introduction of disease as has been shown by the world-wide spread of influenza. Let the people or animals out of quarantine and they immediately give off the germs from which they are immune to people who are not immune, and vice versa.

Our previous knowledge of ticks as carriers of blood poisoning parasites has been summed up to date in their new edition of the Manual of Bacteriology, by the distinguished scientists,

Doctors Robert Muir, Pathologist of the University of Glasgow, and James Ritchie of the Royal College of Physicians' Laboratory, Edinburgh. Of Piroplasmosis they say:

"Up to the present, no human disease has been proved to be associated with the presence of piroplasmata, but several important diseases causing world-wide devastation of domestic animals are almost certainly caused by protozoan parasites of this group. Humans, however, bring on erysipelas and blood poisoning by scratching the irritating bites.

"The Piroplasmata are pear-shaped one-celled animal organisms from one to one and a half micromillimeters long, and varying in breadth. The outside wall is dense, the inner section appearing often as if vacated. At their broad end there is a well staining mass of chromatim. The organisms are found within the red corpuscles of the infected animal and also free in the blood generally. In the former situation there is sometimes only one within a cell, but the number varies under different circumstances and in different species. Multiplication takes place by fission, or dividing into two parts, each part becoming a new parasite. The new parasites remaining for a time in opposition, account for their different appearances or shapes in the cells. The forms free in the blood may obtain entrance into the red cells by means of pseudopodia, or prolonging their pointed ends of protoplasm. Infection is usually carried from infected animals by ticks. In one case, Koch has described the development of the organism, in the stomach of the tick, of spiked protoplasmic processes sprouting out from the broad end of the protoplasm, and the joining of two such individuals to form a zygote, or fertilized egg. Observations by Christophers indicate that a new globe-shaped body now appears, called the oöcyst stage, and further development consists in a division into sporoblasts, or minute bodies which may affect the whole tissue of the tick, especially the salivary apparatus. The eggs also are affected, and the young ticks developed from these are capable of carrying the disease to other animals. Frequently when an animal has passed through an attack of piroplasmosis, it is thereafter immune to the disease. If the parasites have not disappeared from its blood, ticks feeding thereon may give the disease to other animals not immune.

"The parasite Piroplasma bigeminum, according to Theobald Smith, is the cause of Texas, or red water fever, a febrile condition which occurs in the Southern States of America, Argentine, South and Central Africa, Algeria, various parts of northern Europe and in Australia. The organism gets its name bigeminum from the fact that it is often present in the red blood cells in pairs, which may be attached to one another by a fine thread of protoplasm, the result of delayed division of the cells. The infection is spread by the tick, Boophilus bovis, and some of the characteristics of the disease are explained by the fact that this insect goes through all of its moultings on the animal on which it alights.

"The parasite Piroplasma parvum was discovered by Theiler in the blood of cattle suffering from the African East Coast fever, a disease closely resembling the Texas fever. It affects a long strip of coast in Africa and periodically extends inland. The organism is small and attenuated. It is the parasite of the tick Rhipicephalus appendiculatus, and it drops off from cattle to do its moulting. It can carry an infection much more quickly and widely through a herd of cattle than the carrier of the Texas fever.

"The parasite Piroplasma equi, gives rise to binary fever of horses. It also is a South African disease, carried by the tick, R. evertaii. Theiler noted that when the blood of a donkey which had survived the disease was injected in a horse, the horse suffered but slightly, thus suggesting a possible line of immunity. The parasite Piroplasma canis infects dogs through infection by ticks."

Examining a newly arrived anaconda from Central America for ticks

Man is affected by both ticks and chiggers of the Order Acarina. The chigger is a strange insect because he, or rather she, is so particular. The female drops off a tree onto a man's neck and goes under the clothing by way of the space between the collar and the neck. The upper part of the man, however, doesn't contain her particular delicacy. She descends to a point below the knees, sticks her bill down under skin and lays eggs in the human blood. Dr. H. F. Chittenden of the Department of Agriculture, Washington, says of them: "These pests are the larval, or six-legged form, of harvest mites, the adults of which have eight legs. Soon after Leptus irritans burrows under the skin, through the larger sweat pores, a small red spot appears, after which the surrounding surface becomes congested, the affected area spreading. The inflamed spot later festers with a water blister. If the victim gets frantic because of the resulting irritation and scratches the skin, erysipelas or blood poisoning usually follows."

In Central America, a chigger burrows under the toe nails of humans, usually causing the loss of the nails, after the eggs hatch and the larvae cause ulcers. Effective treatment has been had by use of permanganate of potash, used in the same manner as in case of snake bites.

At the Bronx Zoölogical Garden is the

(*Continued on page 266*)

Copyright, Press Illustrating Service

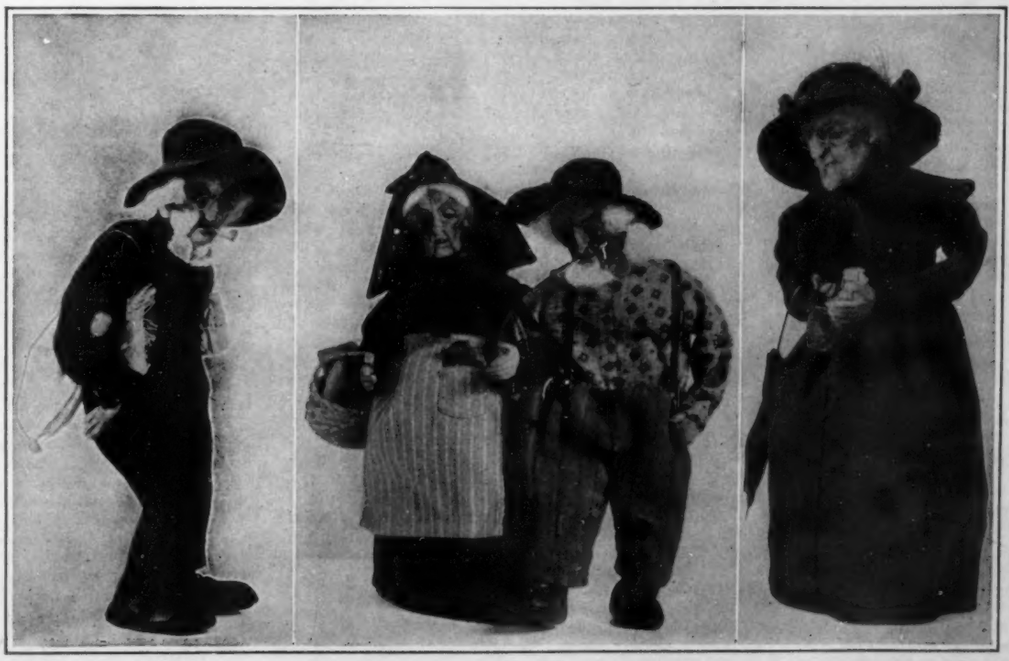
This young lady has discovered the possibilities of dried-apple sculpture and has made it a novel art

Dried-Apple Sculpture

DOWN in Knoxville, Tenn., lives Miss Isabel Million, who has created a new and distinct art. To be brief, she has developed dried-apple sculpture with remarkable results, as is evident from some of her work depicted in the accompanying illustrations.

For years Miss Million has been interested in the various types of mountaineers who came down to her father's store to trade. Having artistic ability, she tried a good many times to model their quaint and weather-beaten faces by the conventional methods of sculpture, but the results did not satisfy her. One evening, while cutting apples to dry them for the future, she picked up a piece of partially dried apple and noted its striking resemblance to the wrinkled face of the usual elderly mountaineer, whom she had endeavored to portray. Taking up a sharp knife, she did a little cutting so as to fashion the wrinkled apple into a human face. The outcome was most successful; she saw possibilities in this newly discovered art; and she set to work experimenting in dried-apple sculpture. Little by little she became quite expert in making dolls whose heads are simply dried apples, cleverly cut before they are dried.

Miss Million has found a satisfactory preservative with which she varnishes the dried-apple heads when they have reached the desired state of dryness. The costumes and accessories are carefully copied from life; indeed, Miss Million always has some particular person in mind when she evolves a little doll with a dried-apple face.



Copyright, Press Illustrating Service

Examples of what can be done in the way of dried-apple sculpture, each doll simulating a living Tennessee mountaineer

The proposed North River Bridge at 59th St., New York. Length of main span 3,000 ft., height of towers 600 ft., capacity: 8 steam railroad tracks, 6 trolley tracks, 2 automobile roadways and 2 passenger promenades

Railway Terminal Problem at the Port of New York

Plan for Bringing Manhattan Island Into Close Connection with the Railroad System of the United States

THE New York and New Jersey Port and Harbor Development Commission recently invited Gustav Lindenthal, who designed the Hell Gate arch bridge, to give his views as to the best method of solving the transportation problem at New York, particularly with regard to the Hudson River and the transfer of freight and passengers between New Jersey and Manhattan.

Earlier Attempt to Solve Problem

We recently drew attention to the fact that over a quarter of a century ago the urgent need for better communication between Manhattan Island and the main land was fully recognized. The great railway systems that terminate on the Jersey water front were particularly concerned with this problem, and an attempt was made, under the initiative of the Pennsylvania Railroad, to get combined action of all of the railroads for the erection of a great bridge across the Hudson River for the accommodation mainly of the steam railroads, but also of trolley tracks and vehicular traffic. Partly because of the inclination of the railroads of that day to throw the greater part of the burden of construction upon the Pennsylvania Railroad, and partly because the development of the electric locomotive removed the principal objection against tunnel traffic, the bridge project was abandoned and the Pennsylvania Railroad built its own tunnels at 33d Street.

The Present Enlarged Scheme

The plan which Mr. Lindenthal presented to the Commission is shown in the bird's-eye view of Manhattan and Jersey City which will be found on the front page of this issue.

So far as the railroads are concerned, it will be seen that every one of the systems which now terminate in Jersey City will have direct entrance into Manahattan for freight and passengers and also unbroken communication with the railroad systems on Staten Island, on Long Island and in the New England territory. The system is so arranged, moreover, that all railroads which enter, what it is hoped will be, the "free port" of New York will have direct access to tidewater throughout all the stretch of shore frontage both on the Hudson and East Rivers and on the Upper and Lower Bays.

The total estimated cost of the project is $211,000,000—a large sum considered by itself, it is true, but not so large in comparison with the total cost of approximately $500,000,000 of the subways, used merely for local passenger transportation in Manhattan and Brooklyn.

What It Is Proposed To Do

The main elements of this comprehensive scheme are as follows:

1. A belt line situated about two miles from the Jersey water front and intersecting all the railroads that run to tidewater.

2. A large freight classification yard for breaking up and reassembling freight trains for dispatch to the several destinations of the freight.

3. A railroad and vehicular bridge across the Hudson River opposite 59th Street, Manhattan, by which freight and passengers from the West could be carried directly into Manhattan.

4. A large central passenger station 800 feet long by 460 feet wide to be built in Manhattan.

5. A two-deck elevated railroad with four tracks on each deck, leading from the bridge and extending along the Hudson River water front of Manhattan Island from the bridge to the Battery, and a tunnel at the Battery connecting the southern end of this elevated railway with the railway system in Jersey City.

6. In later years, when the system outlined above is completed, it may be extended by carrying the marginal elevated railroad around the Battery and up the easterly shoreline of Manhattan on the East River, and also by building a tunnel from Greenville, N. J., across to Brooklyn, to connect with the existing railroad system on Long Island.

Hudson River Bridge, the Key to the Situation

It will be realized at once that the most important link in this whole project will be the huge bridge across the Hudson River at 59th Street. Because foundations in the middle of the river would have to go down from 250 to 350 feet to find rock bottom for a pier in mid-river, it is absolutely necessary to span the entire width of the Hudson without any intervening pier. This means that between towers the bridge must measure 3,000 feet, which is about double the span of the existing Brooklyn suspension bridges. Good rock foundation can be found on each shore of the river upon which the main towers, each over 600 feet in height or about the height of the Singer tower in New York, would be erected. The bridge would be carried on four cables, each of which, if built of wire would be five feet in diameter, as compared with the 15-inch diameter of the cables of the old Brooklyn Bridge. To get the necessary girder width to resist the enormous wind stresses, the bridge would have to be about 175 feet in total width, and this, on a two-deck structure, would provide on the lower deck room for four freight and four passenger-train tracks; and on the upper deck, for six rapid-transit tracks, two wide driveways, and a passenger promenade. By far the greatest load that the bridge would carry would be the deadload of its own weight. "All the heaviest trains," says Mr. Lindenthal, "and all the vehicular loads that could be put on the bridge would be only as a string of flies on a heavy wash-line."

Continuous Boulevard, Long Island via Manhattan to Jersey

One notable advantage of the bridge, which will commend itself very widely, is that it would do away with the present irritating congestion and delay which trucks and automobiles have to endure in getting across the Hudson River. The slowing up and congestion of vehicles for the purpose of paying toll could be avoided by making highway traffic over the bridge absolutely free from tolls. It is estimated that the automobile traffic alone over the bridge would exceed 6,000,000 cars per year. Its capacity for motor-truck transport would be very great; this is estimated at 100,000 tons of freight every 24 hours.

Classifying and Distributing Freight

The idea of a classification yard on the New Jersey side is an old one, and its advantages are evident. Under this method the different railroads would send their freight into one yard, where the cars going to the same destination would be combined into separate trains and sent to their local stations. Conversely, returning empties would be made up into trains for dispatch to the various railroad systems. As the trains reached the Manhattan side of the bridge they would pass down the elevated railroad on West Street and, ultimately, when the system is extended, would continue up the East River front. The average haul to and from this elevated structure for store delivery would be from one-half to three-quarters of a mile.

It is evident that the Hudson River bridge at 59th Street, and the tunnels from the Battery to Jersey City for empty returning cars, would offer a circular system of transportation of great capacity and elasticity for the handling of every kind of freight. The marginal elevated railroads, moreover, would be associated with a system of warehouses, manufacturing lofts, market halls and freight stations, which would be located alongside the elevated structure. The freight could be delivered by gravity to street level and there picked up by motor trucks for distribution.

Although the bridge would cost about $75,000,000, so great would be railway track capacity that it would take 18 tunnels to provide the same amount of accommodation. It is perpetually reiterated that a tunnel is much cheaper than a bridge. As a matter of fact, compared on the basis of capacity, it is very much dearer.

Question of Financing

Speaking on the question of financing, Mr. Lindenthal told the Commissioners that as the result of a thorough investigation of this question for many years, he believed the interests of the public would be best served by a separate terminal organization acting as an agent and trustee of the Federal Government, and that such an organization with large capital is in process of formation. Because of the multifarious advantages conferred, not merely to passenger and freight traffic but to the automobilists and to real estate and other interests, particularly in New Jersey, he is satisfied that no public funds would be required and that private capital will willingly come forward to build, equip, and operate the entire improvement, when once it is sure of the joint coöperation of the railroads, the City of New York, the communities on the New Jersey side, and of the United States Government.

Lead Poisoning from Nursing Bottles

FOR several years nursing bottles for infants have been made of a kind of glass known as crystal instead of ordinary glass, because the former is much tougher and, therefore, less liable to break during the process of sterilization. A few weeks ago a French physician, Dr. Guerbet, made the startling statement that he had found that a case of chronic poisoning in an infant three months old was due to the lead derived from the glass in which the infant's milk was sterilized. Ordinary glass does not contain lead whereas "crystal" glass contains a considerable percentage. Upon careful experiment Dr. Guerbet found that milk sterilized in bottles made of ordinary glass contained no lead, while that sterilized in crystal bottles contained from 3 to 9 miligrams.

It is a well known fact that when salt water is sterilized in crystal flasks lead chloride is formed, even if the content of salt is only nine parts in a thousand. Dr. Guerbet believes that a similar action occurs through a slight alkalinity of the milk or the chlorides it contains. While the amount of lead thus dissolved of the milk would, of course, be very small, it might easily become injurious in the course of time since lead is what is known as a cumulative poison, *i. e.*, instead of being immediately eliminated it accumulates in the tissues until a sufficient quantity is present to act as a serious poison. Dr. Guerbet goes so far as to demand the passage of a law forbidding crystal glass to be used in the manufacture of nursing bottles or other glass ware employed for cooking or sterilization.

The Ford "Eagles"

AS part of our naval policy against the U-boat it was decided to build 100 steel vessels of about 500 tons displacement and 18 knots speed and dispatch them to European waters. They were of a mongrel design, unlike anything existing here or abroad; indeed, in naval eyes they were neither "fish, flesh, fowl nor good red herring." Too small for service on the high seas; too slow for effective submarine hunting; wedge-bowed and slab-sided, they are an object-lesson in the folly of political and lay interference in such a highly technical matter as that of determining what kind of vessels should be built for naval purposes.

For it is no secret that these boats were built against the advice of those naval officers whose duty it is to determine what are the needs of the Navy and what kind of vessels will best meet those needs. Just who was responsible for these nondescript craft, nobody seems to know; but the recent hearings before the House Naval Affairs Committee developed the following facts:

1. That a total order for 110 of these boats was given to Mr. Henry Ford, or, to be more exact, to the Ford Motor Company.

2. They were to be paid for out of a $100,000,000 Emergency Fund, known as the Presidential Emergency Fund.

3. That the contract price was $275,000 per boat, and that there was to be a fixed profit of $20,000 on each.

4. That (according to the testimony of Chief Constructor Admiral Taylor) they have cost at least $400,000 per boat; and that the armament will add $110,000 to that sum.

5. That Ford put up a shop 350 feet wide by 1,400 feet long in which to build the boats by "Ford methods," and that the Government furnished $3,500,000 to finance the job.

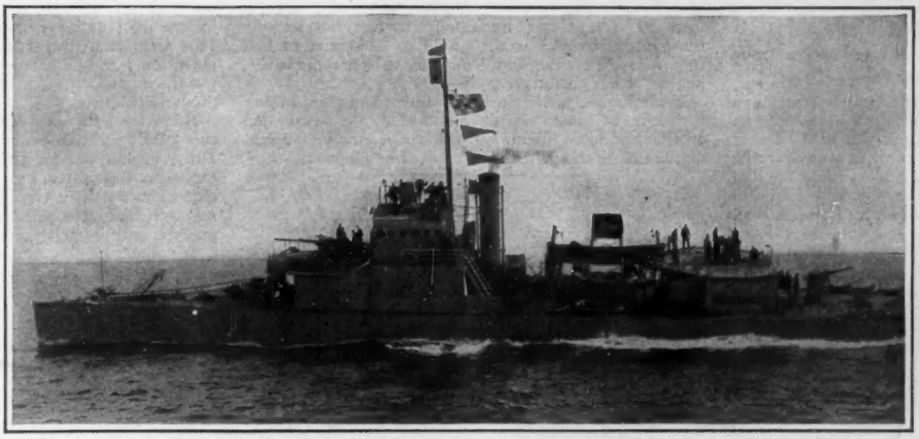
6. That when the armistice was signed, only seven boats had been completed; that five of these had started down to the Atlantic, and that they only got as far as Quebec, where they were frozen in for the winter.

We understand that the contracts for 50 of the 110 have been cancelled and that the other 60 are to be completed.

Good looks we are told were sacrificed to speed of construction. The above facts show that we did not get the speed, and a glance at the photographs shows that we certainly did not get a nautical beauty. The main armament consists of two four-inch guns, one mounted forward of the bridge, the other on a deck house aft. There is an anti-aircraft gun on the quarter-deck.

The picture shows that the Eagles can do some lively rolling, even when the sea is in a peaceful mood; what their antics would be in a fresh breeze and a lively sea can be left to the imagination.

And what a gun platform!



One of Ford's "Eagles" on her trial trip

The Battle-Cruiser "Repulse"

OF the new ships, built for the British navy during the war, none have created greater interest than the "Repulse" and "Renown." When the war started they were included in the 1914 program of new construction. These two and another ship were intended to form part of the "Royal Sovereign" class, ships of 25,750 tons displacement and 21 knots speed. On the outbreak of war, at the instance of Lord Fisher, a strong advocate of the battle-cruiser, the plans of two of the ships were redrawn on battle-cruiser lines.

Persistent reports of a semi-official character led to the belief that these ships were considerably over 800 feet in length and of 32,000 to 33,000 tons displacement and 33 knots contract speed. If the *London Engineer* is correct that is an over-statement and the length is slightly under 800 feet and the contract speed was about 31½ knots—the highest speed on trials being 33 knots. The armor is light and disposed on a novel plan, protection against sinking by gunfire and torpedo being assured by an elaborate system of cofferdams and subdivision.

We present what we consider to be the best photograph of the type which has reached this side of the water. They are shapely vessels, in which lofty superstructures have been avoided, the masting, smokestacks, etc., being of moderate height—the target presented to enemy gunfire being thus relatively small for ships of this great size. The displacement being less than 30,000 tons, and the engine power large (reported to be 112,000) the armament is lighter than that of the "Royal Sovereigns" which they superseded. Only six guns are carried in the main battery, viz., four 15-inch forward and two 15-inch aft—the former in two turrets with super-turret fire for the guns of the forward turret of the pair.

A novelty is the adoption of the all-centerline position for the torpedo battery of 18 4-inch guns, which are mounted in three-gun shield mounts, open to the rear. Also the director-fire principle has been applied, all the guns being trained and elevated from a single fire-control station by the fire-control officer. This method has been in use for some years for the main batteries, and this is the first time, as far as we know, that it has been applied to the secondary batteries. The results have given great satisfaction.

The hull of the ship, forward, is marked by a pronounced flaring out of the bows above water—a doubtful advantage as it results in heavy pounding if the ships are driven hard into head seas. It is stated that the vessels have had to be strengthened by extra bulkheads, amidships to meet the bending stresses.

These two battle-cruisers, built on the Clyde in 17 months, constitute a record for rapid construction of capital ships.

Substitutes for Platinum

THE question of substitutes for platinum has received almost world-wide attention, many nations having been obliged to devise something. Most of the platinum came from Russia before the war. Germany was no exception. Some of the recent substitutes are enumerated in a German paper. The most important seems to be that suggested by Gotthold Fuchs, of Berlin, consisting of a wolfram-gold-nickel alloy which can be cast, forged and rolled, is of a light color and polishes brightly, which platinum does not. Another substitute is an alloy of silver, wolfram and nickel. Both these alloys are stated to be acid resisting. A nickel-iron alloy, known as platinit, is said to be serviceable as a substitute for platinum in glow lamps, its coefficient of extension being similar to that of glass. For laboratory purposes an alloy of nickel and chromium affords a platinum substitute for wire and sheets, but cobalt alloys, such as cobalt-iron and cobalt-chromium, are as serviceable, especially for acid-resisting purposes.

According to the German chemical paper *Chemiker Zeitung*, Professor Gewecks of Bonn University, who has been experimenting to find a substitute for the platinum dishes weighing from 30 to 40 grammes, which are used as cathodes in analysis by electricity has found that glass dishes silver-plated inside can be used to great advantage. In order to make the silver coating adhere properly to the inside of the glass its surface is first sand-blasted, by which a better result is obtained than by the use of hydrofluoric acid. The dishes must be thoroughly cleaned, first with chromic acid, then with soda solution, and finally with nitric acid, before the first silver-plating. An ammoniated solution of silver nitrate, reduced by the addition of two com. of 40 per cent formalin solution, is the most suitable vehicle for plating. At a maximum temperature of 30 degrees a deep blue silver precipitate of from 0.03 to 0.15 grammes is obtained in three or four minutes. The dish, previously dried, is provided with a strip of platinum sheet 2 mm. wide; one end must touch the silver coating, while the other end is bent over the rim and attached with a screw.

H.M.S. "Repulse," a battle-cruiser, 800 feet long with speed of 32-33 knots. Carries six 15-inch guns. This ship was built in 17 months at beginning of war

World Markets for American Manufactures

Edited by LYNN W. MEEKINS

A department devoted to the extension of American trade in foreign lands

Expert Exporting

Some Suggestions for the Middleman in Foreign Trade

By an Exporter of Forty Years

THE house that buys all over the United States and sells all over Latin America is a middleman—an export middleman. Now the middleman is the fellow whom nobody loves; the manufacturer is always trying to eliminate him, and the foreign buyer would be glad to avoid paying the commission on which he exists. So the right of the middleman to carry on his business is all comprised in the one word, service.

One kind of service has to do with packing and marking. A good deal has been said on the subject of packing against the rigors of South American stevedoring; but there is one aspect of the subject that has been little touched upon. Every exporter should remember, every minute of the time, that the South American customs laws are always on the job, and that they are administered without fear or favor.

In particular, he should remember that duties are usually on the gross weight, but that the rates are arrived at by reasoning what would be a fair impost on net weight. Accordingly the importer cannot afford to have his packages made any more secure than necessity demands. In filling a large order for ladies' stockings the garments came from the factory in cardboard boxes that weighed as much as the stockings themselves; and in these boxes they were again packed in wooden cases that weighed 100 pounds. The duty would have been tremendous, to say nothing of freight at 50 cents per cubic foot. We eliminated the cardboard boxes and the packing cases, and did the stockings up in bales, hydraulically pressed. In this way we saved the Salvadorean customer 75 per cent on his freight bill, and an incredible sum in duties, giving him real service that he could afford to pay for.

In another case where the outcome was less happy the victim was himself to blame. In this country on a visit, he bought a handsome safe for his home office—weight, one ton or thereabouts. Being of an economical turn of mind, he purchased a fine line of silks, handkerchiefs, shawls, etc., and packed them in the safe to save shipping and packing charges. But he made out his consular invoice in such a way that he left the home customs officials no alternative other than to interpret the safe as the container for the silks; so his duty bill read, "gross weight, 1,000 kilos at $4 gold per kilo, $4,000 gold!" He kicked, but to no avail; he refused to pay, and his safe and his silks were sold at public auction. Had a similar error been made by the American exporter, the house would of course have had to stand the loss.

As important as the packing is the marking. Of course the middleman should always pack his goods under his own brands, selecting a short name with a picture, so that the illiterate native can demand the goods by asking for the bear or the horse or the palm. In a few years such a brand will have acquired a very real money value; but the marks must be used with the greatest of judgment, especially when it comes to a question of names. Now it is a delicate touch to brand the purchaser's name on his goods—provided he wants it there. But if he himself is a middleman, he doesn't want it there, because his customers don't want it there; he would have as much difficulty disposing of goods bearing his own name as he would of goods marked with yours. No retailer is going to let the wholesaler advertise himself at his expense, if he can help it. I well remember a shipment of fine sugar-pine boards made to Buenos Aires, with our name stenciled in big letters as shippers. The consignee promptly hired men to scrape our name off the boards, charging the expense to us. It amounted to $150, and we had to pay it. We had been too anxious to serve ourselves, instead of our customers.

If marks are to be used sparingly when they betray the source of the goods, we cannot make the destination or the route too plain. If the goods are in straight wooden cases they should be marked as follows:

S del C.
BOGOTA
GIRADOT
BARRANQUILIA
NEW ORLEANS

The initials must be four inches high and the towns two inches. This shipment speaks for itself; it shows that it goes to New Orleans, thence to Barranquilla by sea, to Giradot by river steamer, to Bogota via rail and mule. If the goods are in bales with iron hoops, do not try to stencil the shipping marks on the burlap surface; they will not show up. Get a printer to print them on pieces of cotton cloth, and fasten these under the steel bands. The loss avoided on one shipment gone astray will pay for years of such marking; moreover, goods thus marked, when identified to port officials by photographs accompanying the documents, habitually get to their destination weeks or even months ahead of those that are left to take their chances in the regular course of events.

Tallow and tea for transfer across the Andes. In each instance the individual containers are shown on top of the pile of cases

Another important consideration in packing is the size of packages. Labor in Latin America is all by hand, and the native workers have little muscle and less energy. The heaviest case that should be made up is one of 120 pounds gross. This can be nicely handled by one man or by two; and two of these cases make a good mule load. But if the goods are to go where transportation is via llama they should weigh but 50 pounds per piece, since the limit for this animal is 100 pounds, properly balanced.

Nor is size the only feature of a package; it may be susceptible of improvement in many other respects. Dried shrimp had for years come from Mexico, for re-export, in second-hand sacks of any old size and weight. But when we got a big order for these shrimp from the mines in Chile, the price and the freight were such as to make it certain that the buyer would expect to receive every pound he paid for. So we repacked the shrimp in neat wooden cases, with a brand; and now we get all the orders. We repeated this performance, with similar results, in the case of tallow, which had always gone out in old oil-tins that were in poor condition when they started the trip, and which we shipped in heavy tins, specially made, and each incased in a wooden framework.

When you have got the goods all packed and ready for shipment, you have got to supply your customer with invoice, bill of lading, and insurance policy. Don't stop there; try to think of something else that he could use and that you could give him. One such thing is photographs. You can, for a couple of dollars, supply him with a couple of dozen pictures of his shipment; pictures that will show the handlers of the goods en route what they are, pictures that will show the buyer how the goods are coming to him, pictures that will show his customers what the goods are and how they are coming to them. After doing this awhile, you will be surprised to discover what a big selling factor such pictures are; they sell your customer, and they sell him indirectly by selling *his* customers. When a man is forced to buy goods sight unseen, and often to sell the same goods without ever having seen them, the possession of photographs telling him how they are to be packed, right down to the outside case, is a tremendous comfort to him.

Similar in content, but somewhat different in purpose, is the provision of documents that will show beyond question that your goods left the pier in proper order. A well regulated sugar refiner is always glad to have an outside chemist make an analysis, as it gives him a check on his own factory; but a sawmill turning out box shooks by the carload is not always so careful as to measurement or count when they know that the middleman who pays the bill will never see the goods. The $10 per car for a Chamber of Commerce expert tally is here money well spent.

Such goods may not reach the consumer until they get to Lima or La Paz, thousands of miles away and thousands of feet up. Then they may not be just what was expected; and what are you going to do about it when the consignee refuses to pay? You can't do anything—unless you have your Chamber of Commerce certificate, with a clause in your contract providing that this certificate is final evidence of quality and weight of the shipment. I have seen thousands of dollars saved in claims by proper attention to these certificates, and as many thousands lost by failure to have them. They are not to be thought of as a means for beating your customers but rather as a means for convincing them. They make it possible to say just where the trouble lies; and in particular they make it certain that you will get back at your wholesalers before the evidence of their faults has passed out of your hands.

A case in point relates to our experience in shipping California dried fruits in large quantities to Buenos Aires. The claims for short weight, bad quality, improper size, etc., got so serious that we thought

(Cont. on page 267)

Left, wine in kegs for mule-back transfer, before and after the outer casing is put on. Center, dry-goods cases for rough handling. Right, the effective way to mark baled goods by means of a printed cloth label inserted beneath the hoops

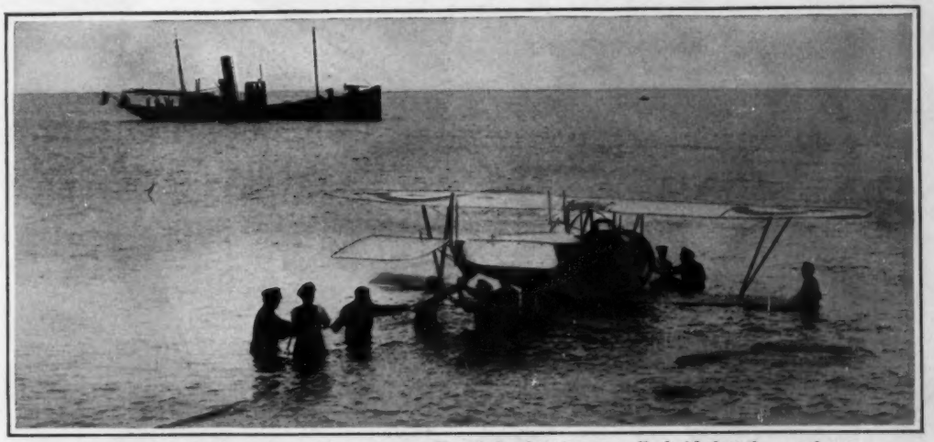
Future of British Flying

What the British Government Is Doing in Preparation of the Coming Civilian Aviation

By C. H. Claudy, Special Correspondent of the SCIENTIFIC AMERICAN Now in London

EVERY one realizes that the war has forced a hot house development of aviation, which has accomplished the technical and constructional advances of 20 years, in the past two. What apparently is not generally recognized, is that the greatest advances have been made, not in France, not in Italy, in spite of the Caproni and its wonders, not in the United States, for all know no other country could put a satisfactory high-horse-power, low-weight engine in production, but in England.

The development of the flying machine, the flying machine pilot and the flying machine factory in Great Britain is something which positively staggers imagination. I hope to tell at least the main outlines of that enormous accomplishment later, if for the time being it can be assumed that the size of the industry is enormous and that only the armistice prevented its flowering to proportions at least double the capacity the United States talked about and did not achieve—20,000 engined planes a year—a common ground can be reached whereby we may consider that the future of British aviation is not unlikely to be the future of the world's aviation. Certain it is, however doubtful that may be to some Americomaniacs, that the United States must look to its air industry, its air laws, its civil aerial transport and look *quickly* or Great Britain will have forged as far ahead of us in this utilization of this greatest of gifts of war to peace, as she has in her war aviation program.



Seaplane accidents such as this one are rare. Indeed, it is generally held that the seaplane is best adapted to civilian flying

These forty men and women were recently carried aloft by a British Handley-Page bombing plane, indicating its peace-time possibilities

It is too early as yet to speak with any certainty as to just how Great Britain in general and the United Kingdom in particular is going to go ahead with the civil aerial transport idea. It is pointed out on every side where that question of "what" and "how" is asked, that "we are still at war, and no one knows until peace is actually signed, just what sort of an army or naval flying establishment we shall have to maintain." It is also pointed out, although this seems less obvious to the man in the street, that no resumption of the hit or miss civil flying of the old days is possible with the new far, fast and high-flying planes in abundant supply, that new laws must precede civilian flying and that an international agreement on international laws should precede local laws, and that no international convention on air laws is likely to be formed until the peace conference has finished its work.

But if the particular "why" and "how" and "what" of future British civilian flying is as yet indeterminate, there is nothing vague or chaotic about the preparations made against the time when peace and laws duly made and passed make possible the beginning of the great development of civil aerial transport to which Britain looks forward.

To begin with—and to go a long way, with as far as that goes!—Great Britain's forehanded government appointed a Civil Aerial Transport Committee nearly two years ago—in May, 1917—with the avowed objects of considering and reporting to the Air Board (since replaced by the Air Council) regarding the steps to be taken to mark the development and regulation after the war, of aviation, for purposes both civil and commercial, considered first from the domestic, second from the national and finally from the international standpoint and to ascertain the extent to which it would be possible to use both trained personnel and existing aircraft which might be, at peace, in excess of the requirements of the army and navy.

In the language of the United States it was "some" committee, and it turned in "some" report. Reference is not made to the distinguished personnel, although such names as Northcliffe and H. G. Wells ring familiarly upon American ears. It was a great committee because it did a great piece of work.

It divided itself into five broad divisions, and rendered at least one, and oftener more than one report on each of these subjects. They are, first, Law and Policy; second, Technical and Practical Questions of Aerial Transport; third, Business Questions Relating to the Aircraft Industry and Aerial Services; fourth, Labor; and fifth, Research and Expert Education.

This comprehensive scheme has been followed in the most exhaustive manner and a complete and printed report made some time ago. So far it has produced no result governmentally other than discussion and no one in the Air Ministry ventures a prediction as to what the Cabinet is going to do with it. "Get on with the war" has been so long at once the slogan and the excuse for anything and everything over here, that now that there is no war to get on with, and a peace discussion which seems fairly likely to take the government's best attention for some time, the government is a bit loathe to jump right into anything as big as a civil aerial transport scheme, even though a hard working committee *has* drafted out the whole plan ready for action.

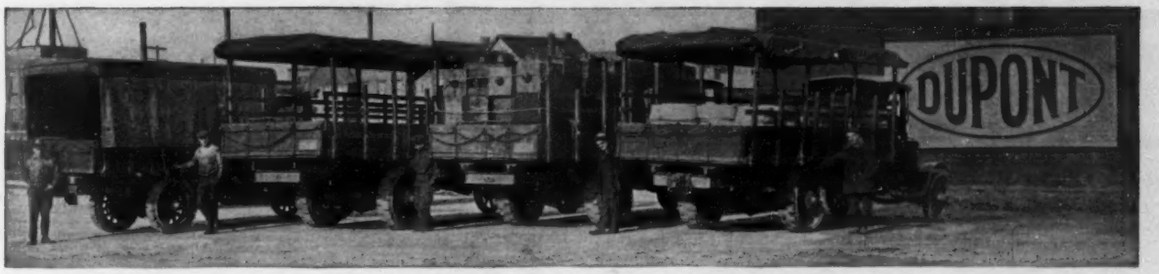
But the report and the discussion of it have had one very far reaching effect—they have turned many minds to the question and much sober thinking and earnest discussion have taken place. Also the industry itself, which was suddenly, like a bolt out of the blue, faced with dire consequences on November 11th, has had a chance to look around and make plans and consider the possibility of continuing or changing itself, with the result that there is little feeling of anxiety and less of panic even among airplane workers.

From the discussion and the thought, as one catches it here and there in talks with this governmental official and that secretary, that clerk and this airplane constructor, this minister and that technical man, come two clear-cut ideas. First, under no circumstances must Britain's immense industry, as created by the war, be allowed to wither and die. Second, equally impossible is it to force a growth of civil aerial transport, merely because one has factories and planes and aviators. To cite a most homely comparison, we had roads and horses and wagons and men for years before we had rural free delivery. When we got it, we got it little by little, bit by bit, and made a success of it. So must it be with any well rounded scheme of civil aerial transport—it must grow as fast as the public will have it, *and no faster*.

If the two ideas seem incompatible, one comes readily to the third which is gripping every one's attention here—government interference, government in control, government monopoly, government participation, government subsidy of civil aerial transport. Some say one and some say another, but nearly every one, in the Air Ministry and out of it, in the trade and out of it, seem to think that only by some sort of government aid can the big industry be kept alive with the war stimulus removed, until the peace demand grows up to the capacity of the industry.

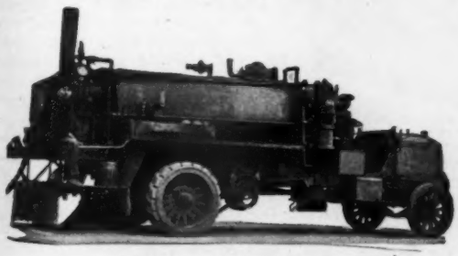
This seems reasonable enough. Unquestionably, the industry is going to be allowed to exercise to its fullest capacity the natural shrinkage which it will admit voluntarily. For instance, there are many plants which are conversions—which were automobile factories or sewing machine plants or button factories, or furniture factories, which turned their facilities to some part of airplane making, when it was realized, two years ago, that

(Continued on page 270)



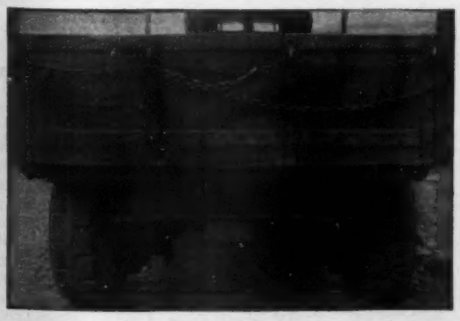
Part of DuPont fleet, Newark, N. J., equipped with Caterpillars.

40 x 12 Caterpillars on specially constructed Pierce-Arrow in Boston, carrying daily 10 tons milk and cream. Mileage when photographed, 4,500. Saving of gasoline, one mile per gallon over other types of tires.



40 x 12 Caterpillars on 6-ton Packard Road Sprayer, operated by Cressey Contracting Co., Boston.

40 x 12 Caterpillars on 5-ton White in Cleveland. Mileage when photograph was taken, 7,000 miles.



40 x 12 Caterpillars on 5-ton White, operated by Perfection Spring Co., Cleveland. Mileage when photographed, 8,000.

OVER the hill of traction progress has come the massive Kelly-Springfield Caterpillar Tire for Trucks—the greatest advance in solid tire construction since the beginning of the industry.

Its elephant-footed sureness and lasting economy have immediately appealed to the heaviest truck users in the world. By a series of *side air pockets* —a new construction fully patented—it gives maximum traction, road contact and resiliency, with minimum vibration and vehicle depreciation.

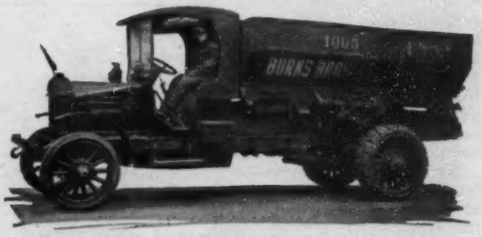
The pockets permit the rubber to flow under load, take up the traction wave, reduce internal tire strain, and keep the tire cooler at all times.

As a new force in world industry, the Kelly-Springfield Caterpillar Tire has taken its place among the mighty.

Kelly-Springfield Tire Company

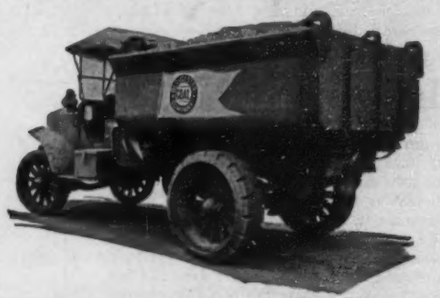
GENERAL SALES OFFICES

4614 Prospect Avenue, Cleveland, Ohio



Burns Bros., New York, entire fleet of 69 trucks is equipped with Caterpillars.

40 x 12 Caterpillars on 5-ton White, operated by Standard Parts Co., Cleveland. Mileage when photographed, 8,000.



40 x 12 Caterpillars on 5-Ton Packard. "Seems to show no perceptible wear.... This tire appears to be the solution of our tire troubles ... Never before had a tire on this truck that has anywhere near run its guaranteed mileage." — *Gloucester Coal Co.*

"This truck has been in service, hauling five to seven tons daily, and the tires show such little wear we believe they will last at least twelve more months."—*The Montgomery Coal Co.*

CATERPILLAR TIRES

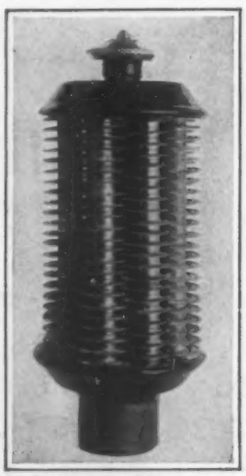
The Motor-Driven Commercial Vehicle

This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The editor will endeavor to answer any question relating to mechanical features, operation and management of commercial motor vehicles

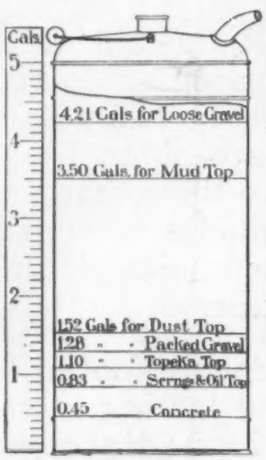
Condenser for the Cooling System

WHEN a truck does hard work, especially on low gear, the water in the cooling system tends to heat up, boil and steam, and consequently considerably water may be lost necessitating extra trouble and inconvenience in filling up. In summer this kind of trouble is aggravated by the hot weather and in winter, when easily evaporated non-freezing solutions are used, the loss may entail considerable expense in addition to the trouble and delay.

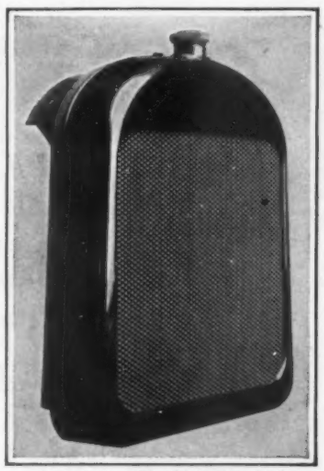
An Eastern manufacturer offers means for eliminating, or at least minimizing, such troubles in a miniature condenser which is placed on top of the the radiator in place of the ordinary radiator cap. The vapor, hot from the radiator, is forced to pass upward through a series of vertical tubes which are provided with flanges to increase the radiation of heat; as the tubes and flanges are exposed to the currents of air the cooling effect actually is considerable. The vapor is condensed and drips back into the radiator instead of being dissipated in the air and altogether lost. In addition to the model illustrated, which is intended for large trucks, radiators are made for small trucks and for passenger cars. In the latter case the cooling element is simply a coil of plain thin-walled copper tubing.



A miniature condenser to take the place of a radiator cap



The cost, in gasoline, of a 20-mile drive over good and bad roads



A motor truck radiator in which 50 per cent of the joints are eliminated

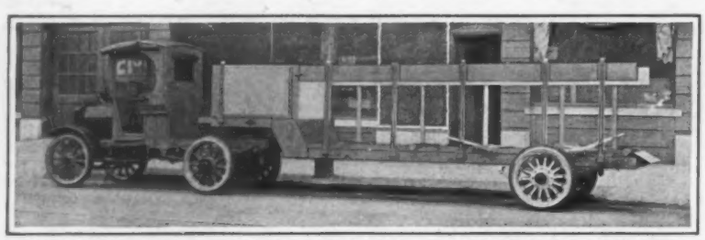
The Missouri Highways Transport Committee has just given out a series of good roads pictures and diagrams, one of which translates the California tests so admirably into terms of dollars and cents that we are impelled to add it to our previous discussion. The diagram in question, reproduced herewith, shows the amount of gasoline that will be consumed in running a loaded automobile for 20 miles over the several types of road which figured in the tests. A fuller statement of just what these types are will be found in our issue of January 5th, 1918.

In preparing this diagram, the California figures are taken for the pounds of tractive effort necessary per ton of load. It is assumed that the automobile, loaded, weighs two tons, and that in delivering one horse-power per hour to the drivers the engine consumes 1.2 pints of gasoline per hour. The gasoline consumption for the different surfaces then becomes a matter of mere arithmetic; and any user of the roads will immediately think of the price he is paying for gasoline and extend the arithmetic to show the cost, *to him*, of the poor roads that he is forced to use in the course of his business.

Easily Loaded Low-Hung Trailer

LOADING and unloading heavy material often is difficult and wasteful of time when it has to be handled to and from the platform of a truck or trailer of ordinary height, and time is money. An appreciable saving is effected when the height is materially reduced. A manufacturer in the Middle West who makes a specialty of trailers has brought out a semi-trailer with the loading platform dropped well below the level of the forward part, which rests upon the rear end of the truck or tractor with the usual turntable coupling arrangement.

The semi-trailer is of 5 tons capacity and is designed for use with a truck or tractor of 1½ or 2 tons nominal capacity; there is a clear loading space of 16 feet at the low level, and the platform is but 34 inches from the ground. The trailer illustrated is equipped with a set of lever-operated rollers by means of which a load of lumber can be dumped intact and left on the ground in a fairly neat pile. For this particular work there is the further advantage that the short distance of the drop is less destructive to lumber than a longer drop. The work of dumping is made as easy as possible by fitting the rollers with roller bearings. The same concern builds trailers to carry up to 10 tons.



A low-hung trailer adapted to haul lumber at a great saving of time and money

Good Roads and Gasoline Bills

SOME time ago we carried an account of tests made in California to determine the tractive effort required by various kinds of road surface; and we illustrated these findings by means of a chart showing the number of horses that would be necessary to haul a given load over the various roads involved. This was all very well, so far as it went; but it did not lay a great deal of emphasis upon the financial aspect of the matter.

Motor Truck Radiator for Rough Work

MOST of the troubles that beset the radiator of years gone by have been eliminated, but the necessity for using thin-walled tubing which is prone to let go at the joints when subjected to the vibration of motor truck service, remains and often causes trouble. One radiator manufacturer has succeeded in making a radiator in which 50 per cent of the joints are eliminated altogether, along with 50 per cent of the possibility of joint trouble. There must be some joints, and these are made by a process which brings the parts together under such heavy pressure that they are very strong and well adapted to resist vibration. A material reduction in weight has also been brought about by careful designing and distribution of metal, without making the radiator less substantial than former models.

Using wing plows to widen the swath cleared by the snow plow

Using the Truck as a Tractor on the Farm

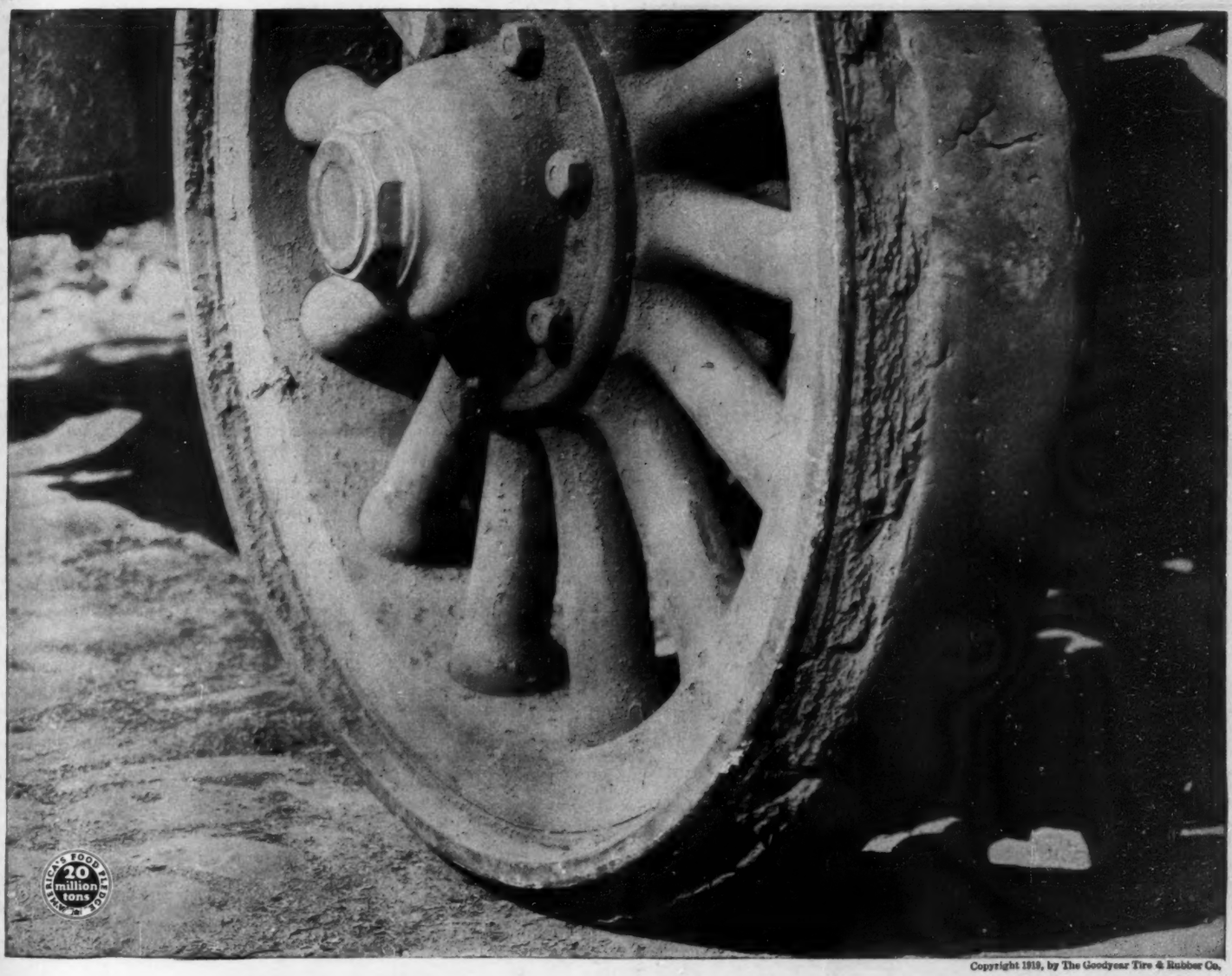
A COLORADO farmer has found a new use for his motor truck. He has been in the habit of using a big tractor to haul two wheat drills, and was able to put in 30 acres of wheat in a working day. A motor truck was used to carry seed grain to the drills because there was no way of carrying it on the tractor. The expedient was tried of putting the wheat on the field ahead of the tractor, to be picked up in the course of the work; but this did not work well, largely for the reason that cattle found the grain and devoured it.

So the farmer tried the experiment of using the truck instead of the tractor to pull the drill, at the same time carrying the seed wheat along with it, and the result surprised him. According to his own statement, he covered just as much ground with the truck and one drill as he did with the tractor and two drills, freeing the tractor and one drill for other work and eliminating a good deal of trouble besides. It was also found that the truck packed the soil less than the tractor. It would seem that the truck, following the suggestion thus brought forward, might well become an important feature of the farm machine equipment, doing in addition to what is ordinarily recognized as its own work, certain jobs that fall between the province of the tractor and that of the horse or the unaided man.

Clearing Roads of Snow

BREAKING out country roads after a heavy snowfall is by no means an easy task; nevertheless, it is something that must be done in view of the fact that road traffic has assumed greater importance than at any time in the past. Motor trucks require good roads for their efficient operation, and the roads must be kept in proper shape regardless of seasons.

The power of a big truck is more than sufficient to push an ordinary plow through ordinary snow, so wing plows often are added to increase the width of the swath cleared. The illustration shows a truck built by a well known middle western concern fitted with such wings, in addition to the ordinary plow at the front. In order to clear telegraph poles, trees, fences, bridge railings, etc., as well as to allow vehicles to pass, the wings are arranged to hoist to any desired angle. The crew of the snow-plowing truck consists of five men; the driver, a man to operate the front plow, a man for each wing plow and an extra helper. The truck can make a speed of from three to six or seven miles an hour, according to the depth and the density of the snow.



"DESPITE running for 3 years and covering 40,000 miles, the original set of four Goodyear S-V Solid Tires are still doing good work on one of our 1-ton trucks. They are economy tires."—Charles W. London, for The Baltimore Chair & Furniture Company, Baltimore, Maryland.

THE set of four Goodyear Solid Tires mentioned above cost $149.70.

Consequently, they have served at the astoundingly low figure of less than a tenth of a cent per tire-mile.

In addition, this company reports that Goodyear Solid Tires on two other trucks are demonstrating the same kind of wearing qualities.

Users of Goodyear Solid Tires frequently report mileages ranging from 20,000 up toward the score reached in this case. Their economy is the firm basis of their widespread adoption.

THE GOODYEAR TIRE & RUBBER COMPANY, AKRON, OHIO

GOODYEAR

AKRON

Disentangling the Tangled Ruins of France

THERE is work for all the house-wreckers of the world in the devasted regions of France. Mile after mile of villages and cities and industrial communities lie in more or less complete ruin, and it is generally accepted that the state of destruction is such that the existing structures must be razed to the ground before reconstruction can begin.

The Germans have done their work well and thoroughly—from their standpoint. Their attempt to cripple France industrially for years to come has been carefully thought and systematically wrought. For instance, factory structures of steel have been fiendishly collapsed by sawing through most of the supporting steel columns and then wrecking the remaining supports by means of small charges of explosive. Buildings of brick and stone have been tumbled to earth by clock-work-operated mines. Railroads have been destroyed by explosives, leaving a mass of twisted steel and huge craters in place of smooth rails and a level roadbed. Nothing so aptly describes the condition of the northern mining districts of France, in the region of Lens, as the aftermath of an appalling earthquake. The roads are lined with tumbled and twisted masses of loose brick and stone, steel beam, corrugated iron, machinery parts, broken glass—a vast junk yard which awaits the house wrecker and the junk man.

Explosives, huge cranes, thousands upon thousands of railroad trains and motor trucks, tens of thousands of laborers, oxy-acetylene torches and electric arc cutters, and other equipment and personnel will figure in putting northern France once more in order. The cover illustration of this issue, which has been suggested by an actual photograph, conveys some idea of how the French will use every modern device to hasten the work of reclamation and reconstruction. Such Gordian knots as twisted steel framework will be cut by means of the oxy-acetylene flame.

The Current Supplement

IN spite of the fact that short-range weather forecasting does not always meet with unqualified success, the weather man is ever on the alert for some means which will give him the ability to make long-range predictions; and the public is interested in this matter hardly less than the meteorologist. One rich possibility consists in taking account of ocean temperatures and movements, which, because of the incomparably greater specific heat of the water than of the air, must exercise a wide influence upon atmospheric conditions. How do surface water temperature changes originate and move? How do these ocean temperatures control atmospheric pressure and winds? What weather occurs with winds that accompany a given pressure condition. These are questions which are asked and, in part, answered in an article *Ocean Temperatures in Long-Range Forecasting*, in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2254, for March 15th. The European oyster is inferior to his American brother; but nevertheless there is a well organized oyster industry in parts of Europe, particularly in Holland; and it is illustrated and described in *Oyster Cultivation in Holland*. *The Role of the Catalyst* discusses this timely subject interestingly and makes the significant suggestion that certain imperfectly understood biological processes are of a catalytic nature. An expert on scientific management discusses in *Science in Cacao Production* the extent to which sound scientific principles have not been applied to this important industry. *The Medicolegal Aspects of Radium Therapy* is an article of timely interest alike to physician and layman. *The Canal in the Problem of Transportation* makes clear the extent to which we have lagged behind Europe in utilising the artificial internal waterway. A British authority discusses *The Lubricating and Other Properties of Thin Oily Films*, a field first brought into the public eye in connection with flotation, but having many other ramifications. A very important contribution is the one on *Agricultural Fertilizers* which makes clear the exact nature and mode of operation of the principal chemicals used for this purpose.

Industrial Democracy and Engineering

(*Continued from page 253*)

democracy and what it can mean, what ideals does it seek to attain? What heights does it strive to reach in its progress?

Obviously, opinions on these points differ and we have plenty of extremists and radicals. However, that is logical and, as a matter of fact, desirable for progress and correct development. Regardless of these differences, however, certain features are especially and persistently evident and, on the important phases, there is at least a similarity in the opinions of the conservative leaders of thought on this subject.

A consideration of these main features might be apropos here, and the writer offers as a possible definition of the aims and ideals of an industrial democracy the following:

First—a condition in industry wherein the various human factors, and especially the three main groups, the owners or capitalists representing money, the managers or executives representing the leadership and brains, and the workers or producers representing brawn and physical effort, each are assured correctly apportioned representation in the counsels and administration of the industries.

Second—a plan of organization under which each of these three groups can correctly function in the utmost harmony and coöperation, securing the maximum production.

Third—an acceptance by all these groups of standard working conditions, hours, practices, etc., to be followed in the various industries.

Fourth—an agreement as to the factors which are to be considered in adjusting the relationships of these three groups.

Fifth and last—a basis and standards by which each group is fairly and equitably rewarded for all effort or interest, which also allows for sufficient incentive to influence individual effort and progress.

While not dealing with all minor points and details and probably without having brought forward any particularly new features, the writer believes these five ideals as outlined give a composite of what is desired in industrial democracy as generally advocated today. Examining into these ideals and with some analysis we find the same two visions as mentioned before the chief basis. We find that besides the two factors, capital and labor, a new one is interpolated, that of leadership. Also, we find in each case an appreciation and realization of the fact that labor's requirements and the individual worker's interest must be carefully and consistently provided for, not only as it has to do with financial reward, but as well all other basic factors underlying our industrial system.

And now, if we have established our arguments that, regardless of whatever else comes in our plan of industrial democracy, there will be included a proper place for leadership and control, not essentially a financial leadership, and there will also be a provision for properly meeting all individualistic needs and requirements; we wish to offer for consideration the work, progress and development of a group of thinkers, students and leaders in this country, who, not only during the rigid requirements of war production, but long before the war started, have visualised and foreseen these tendencies and have been doing very constructive work toward the necessary detailed solutions of the problems involved, as well as the development of the basic principles which must underlie our industrial structure if it is to be permanent. We refer to the engineers of the country and more specifically to that group rapidly

(*Continued on page 266*)

Industrial Democracy and Engineering

(Continued from page 264)

becoming known as the industrial engineers.

It might not be amiss here to give a definition of just what an industrial engineer is. This we will attempt, but wish to point out, of course, that the profession still relatively new, is not yet entirely standardized and the following definition can only be offered as one of several existing. The industrial engineer is an individual who, by training, experience, education and personal attributes is qualified to study the problems of organization, personnel, equipment, buildings and all features of management and control in industrial or commercial organizations, can analyze present conditions, apply remedies where necessary, improvements when possible and, finally, establish standards which are acceptable, practical and permanent.

To those interested, we suggest an examination of the principles which have been developed by this group of engineers. Underlying all their activities will be found a distinct realization of the definite establishment of properly functioning leaders and a plan providing for all those factors mentioned in the forepart of this article as accepted for a correct industrial plan. During the time that the thought of this group has been developing, and probably more especially during the last five or six years, more and more the realization has come that any plan of industrial control, which does not provide an acceptable basis to each and every human factor and individual involved, cannot stand for long, and, hence, they have been making considerable strides in the study of the human problem, and its many and varied sides. Standing as he does in so many cases between the capitalist and the worker, the industrial engineer has become in a sense the coördinator, and it is hoped can more and more fulfill this function to the complete satisfaction of both the other groups.

All this we believe will be found to prove our case, that the industrial engineer, whether intentionally or otherwise matters little, has been definitely and steadily making progress toward the fundamentals of an industrial democracy and should be found a very important factor not only in the industrial readjustments and reconstruction immediately before us, but in the next great step in advance, that of establishing a permanent industrial democracy. We believe the industrial engineer in this country is one of the real dyed-in-the wool industrial democrats.

In any case, we know that this group consisting not only of industrial managers and executives, but specialists, and consultants as well as educators and research students, has dedicated itself to this work and we feel sure that as a result of the work done heretofore and with this as a basis for its future activities, will be found in the end a very active coördinating influence with solutions ready for the many intricate problems involved. Much has been done and now, with the large opportunities ahead, the next several years will see a well recognized accomplishment in these fields.

Ticks as Carriers of Animal Disease

(Continued from page 255)

largest and finest reptile house in the world. The wealthiest men on Fifth Avenue have no more commodious and well ordered establishments. In it was recently, in addition to its world ranging turtles and lizards, the most extensive collection of live snakes ever brought together from the ends and corners of the earth. These snakes cost much money and labor. First, they had to be snared by experts who literally take their lives in their hands. Then they have to be transported long distances, often through many climates, in an atmosphere and under conditions identical with those to which they are accustomed in their respective habitats. When they

Annual Subscription Rates
Scientific American Publications

Scientific American (established 1845) one year $5.00
Scientific American Supplement (established 1876) one year 5.00
Postage prepaid in United States and possessions, Mexico, Cuba and Panama

Foreign Postage

Scientific American $1.50 per year additional.
Scientific American Supplement $1.00 per year additional.

Canadian Postage

Scientific American 75c per year additional.
Scientific American Supplement 50c per year additional.
The combined subscription rates and rates to foreign countries, including Canada, will be furnished upon application

Remit by postal or express money order, bank draft or check

arrive at the Bronx, they must be transferred to glass houses of their own in which are duplicates of their respective environments in the sections from which they came. Daily they must be closely inspected. If any disease develops among them, they must have the same immediate and careful medical or surgical attendance, the same experienced nursing and feeding as mankind. As a miscellaneous collection of reptiles, they are not merely rubbernecked by the million of spectators who annually call to see them; they are studied by large classes of students from the high schools and higher institutions as an essential part of their curriculums; and their respective poses are of interest to several thousand would-be artists.

One of the commonest diseases at the Reptile House is cancer. It is especially prevalent among the anacondas and next, the boas. When it starts among the anacondas, all of that tribe usually go by the board. A huge python was recently attacked, but the disease was diagnosed in time and the life of the great snake, 23 feet long, was saved. She was recently attacked by ticks, but prompt efforts ridded her of these enemies and again her 12-year old life was spared. At this writing, she is shedding her skin and two ulcers have been observed under the new skin. It is believed, however, that these ulcers can be removed and her life again spared. When under treatment, it takes 16 men to hold this great reptile. She objects most strenuously to being handled. Artists and spectators generally regard this python as the most beautifully colored animal extant. Her colorings are superb and blend into each other like the weave of a costly rug. Boas are usually attacked by cancer on the tail, the disease working upward. Anacondas are usually attacked in the floor of the mouth, the disease soon enveloping the whole skull. A speedy symptom is the falling out of the teeth. Cancer, according to the government commission which investigated it, unless hereditary, can only be caused in humans or lower animals by eating some animal that has it. If the person or lower animal has immunity, he escapes. If, however, the cancer germ finds a weak spot in the intestines favorable for breeding, cancer results. The breeding process is so slow that the disease is usually not recognized until too late to treat it. In that respect, it resembles the growth of some of the lowest fungi, and probably belongs to that or a near order of plants. According to the commission noted, the cancer germ is attached to certain species of algae in fresh water. The plant is apparently most eaten by the salmon family, since cancer has raged for some years among trout and salmon, particularly at the hatcheries. Once the germ gets into the hatcheries, it is hard to eradicate. (See government work on "Carcinoma.")

Moodie has recently traced cancer back to the reptiles of the Carboniferous Age, the era of coal formation from plants. Fossils of many reptiles of the coal era show that their demise was caused by cancer. It may have originated still earlier on earth, but there are as yet no older fossils to prove it. The Carboniferous period existed some 15,000,000 years ago. The animals (reptiles) of the period handed the disease down to their successors. Fossils of every age since show the ravages of cancer and other diseases. In fact, it is doubtful if any disease exists in modern times, not prevalent almost since the beginning of life on earth.

Expert Exporting

(*Continued from page 258*)

of giving up the line; but as an alternative we engaged the best fruit broker we could get to check up each shipment and issue a certificate, and we inserted a clause in our contract stipulating that this certificate should be final. The claims ceased at once—for the packers in this country at once gave us a service that would pass our check. Before, we had had no way of

convicting them; so they took no pains to give us what was coming to us, and laughed at any claims we might try to make. The inspection system stopped this loss, and more than that it enabled us to give our customers the goods and the service that they wanted and hadn't been getting.

Similarly in the tallow transaction already referred to, we found that by supplying photographs of the shipment, with weigher's certificates and chemist's certificates of quality, we could give service and get prices that were quite out of the question without these additional service frills.

But if you are safe in giving the buyer double measure in documents, photographs, and other incidentals, beware of trying to give him more than he asks for in goods. Lots of cases crop up where, to save a little time or a little trouble, or to insinuate himself into the good graces of the foreign buyer, the exporter ships a better article than the one ordered, billing it, of course, at the price of the cheaper goods. Don't do this; your customer knows better than you do what he wants, and why; and if he doesn't get what he orders, he doesn't have to accept the substitute.

One such case was an order for rough boards for flooring. The edges were to be tongued and grooved, but the surfaces unplaned. The lumber mill said they would have to make a special run of the order, which would cost more than to sell the planed goods at the price of the rough. So we shipped the planed lumber—and presently we received a bill for $400, representing the customs differential on planed boards as against rough. In another case we shipped an improved chemical reagent, only to find that our customer had no facilities for using this in place of the older and poorer one he had been employing. So of course, he refused to pay for it. These represent but two of many possible reasons why your customers may insist on getting the poorer quality that they ordered, in preference to the better quality that you tried to wish on them at the same price.

On the other hand, if your cleint has made an obvious mistake, it will pay you to use the cable to correct it. When one customer ordered 1,000 tons of wheat we suspected that he meant 1,000 quintals (50 tons), and verified this suspicion before shipping. Perhaps he would have paid for the 1,000 tons; certainly we would have had a lot of argument and some bad feeling if we had shipped it and tried to collect. Another Latin sent us an order for gloves intended as a gift to the President of his Republic; the total value of his order would have been around $2,000. We handled this case differently. We sent him four pairs, made to order after his specifications, at a cost of some $20; and we told him that the balance of the order would follow upon notification that these were satisfactory. Of course he rose to this tactful suggestion by thanking us for our efforts in his behalf, and stating that he would let us know if more were wanted. This was a lot better than shipping him his whole order and then trying to get his money.

Speaking of money—it takes a lot of it to swing a South American export business. The Latin is a notorious procrastinator, and no less so when it comes to paying than in other respects. He will demand long terms, and when his account falls due he may pay and he may not. But make no mistake about this, he will pay, eventually. Debts long past due, in many cases outlawed and written off, have been paid in full. There seems to be something in the blood of these Spanish peoples that prevents their ever forgetting a just debt. If the man who contracted it is so unfortunate as to be unable to pay, somebody else will. I recall one case, from Salvador, where a debt of several thousand dollars contracted by a father was paid by the son some fifteen years after it had been charged off as a total loss.

Another point to be considered is the question of language. A man can travel around the world for pleasure and speak English all the time; I have done it myself. But if he goes to sell goods, of course he must know the language of his clients—Portugese in Brazil, Spanish elsewhere in the Americas—or be distanced by his competitors. I think even the most light-hearted would-be exporters realize that when they send a man to a foreign country, he must speak the language of that country. But that is by no means all that the language amounts to.

Your customers in this part of the world speak Spanish while they are consuming your goods, as well as while ordering them. Therefore anything that you may have to say to them in their capacity of consumers must be said in Spanish—or in Portuguese. This includes instructions for setting up and operating. It includes recipes, it includes lots of things that each exporter must think of for himself, and which will constitute a separate problem for each article exported.

Moreover, your customers are going to order in Spanish, not in English. Unless great care is taken in translation, heavy losses will result. One order sent to New York read *1,000 cajas sebo para minas*, and referred to pure mutton tallow to be burned in the miners lamps. The clerk in the New York office translated this *1,000 cases grease for mines*, instead of *tallow*, and what is known as cup grease for lubricating was shipped. The goods went around the Horn to Antofagasta, and over two ranges of the Andes to the mines in Bolivia, before the error was discovered. Then, of course, the shipment was refused, and somebody paid a loss of $20,000 for bad translation. This would have hired a competent translator for several years, and the case mentioned is not an extreme one, because the excessive costs of shipping to the interior of South America make any error necessarily an expensive one.

I would extend a word of caution to the export middleman who looks forward to the day when he will ship in his own bottoms. In my opinion there is no business, legitimate or speculative, with so much danger as the handling of chartered vessels. It is a business best left in the hands of specialists. I can recall several such ventures that earned losses running into six figures, and one where the deficit came close to seven places. And these were not kitings, but enterprises that had sufficiently favorable outlook to induce the investment of large sums by hard headed business men; nor were the cases to which I refer due to war conditions—they are taken from normal times before the war. Strikes, accidents, plagues, coal and oil shortages, wrecks, market changes, turned the favorable prospects into huge losses. Unless you can support such losses without being crippled, pay the freight that is asked by those who can support them, and be happy that you can avoid them on any terms. A business in which 15 per cent of the invested value of the plant is written off before ever the plant is used, followed by 10 per cent a year for the next five years, is no business for a layman; but that is what the ship-owners have to do.

When a firm grows large enough to do a general exporting business it should have (not necessarily on its salary list, but at its call), a firm of expert industrial chemists, an up-to-date architect, a mechanical engineer, an expert on steamers, a live-stock broker or veterinary—in fact, a man who can handle any situation that can conceivably arise, and some that could not possibly be preconceived. One mail brings an inquiry for a price on a suspension bridge to span a tropical river; the next envelope opens the subject of a trousseau for the daughter of your oldest coffee client; the following one gives forth an order for a thoroughbred Holstein bull and six cows. You will be called upon, as an export middleman, for everything from a needle to an anchor, a freight launch to a pair of game-cocks; and in every instance you must stand ready and able to give your client the best possible SERVICE.

Future of British Flying

(Continued from page 259)

the Hun could not be beaten without he was beaten in the air and that the only way to beat him was to outbuild him. These, or many of them, at least, will seek the easiest path, which will not be that of waiting for flying to grow to their capacity but that of resuming their pre-war status. Some engine factories will turn their facilities to other things than airplane motors and many a workwoman, if not a workman, will resign from construction work to go to home building. But with the natural shrinkage encouraged, the remaining industry which wants to remain in the air industry is going to be larger than unprompted civilian demands can support. Therefore, says the government-ownership enthusiast, "let the government take over the whole industry and run it as it does the telegraph and the post office."

But the men in the industry will have none of it! They don't want to sell out to the government or to become a part of a monopoly. "Let the government help us while we need it," say they, "but let it keep its hands off ownership."

Luckily (it is easy to see what conclusion the writer has adopted as his own!) the powers that already are in the Air Ministry are against government monopoly of civilian flying. Lord Wier, Secretary of State for the Royal Air Force, says "I am convinced that coöperation between the activities of the state and the activities of the private firms will produce the finest results. The state must be the pioneer, it must help, it must encourage, it must guide, it must exercise control—but emphatically it must not monopolize."

What will probably happen will be that the state will be, eventually, to civil aerial navigation, much what it is to civil maritime transportation at the present time. England's mercantile marine is rigidly held to certain standards by law. A ship must not load above her plimsol mark. She must pass an inspection for seaworthiness. Her master and her pilot, her engineer and her under officers, must have certificates of competancy. She can do one thing when she carries freight and much less as she pleases when she experiments with human life as passengers. Her courses are marked on government charts, guided by government lights and buoys, and woe betide the master who goes the wrong side of the buoy or tries for his harbor against regulations as to hour and tide. But the state which demands all this, which pays a mail rate to mail steamers and helps build certain huge liners that they may constitute a part of the navy in time of war, makes no attempt to carry either passenger or freight.

This idea seems to be that which is generally held as practical regarding the coming aerial transport system. Of the mechanical difficulties no one over here makes any fuss. With planes which can land at a fixed gliding angle automatically and with directional wireless, the landing difficulty, as far as fog is concerned, disappears. The legal side of the question presents some interesting possibilities for wrangles, as, how far up can a nation, a municipality, a householder, claim jurisdiction over his or its air, and, claiming it, how can it be enforced? But these are details. Perhaps the greatest stumbling block, in the eyes of those who know, to a speedy development of civil aerial transport, is the lack of governmental sites for airdromes—and that of course can be overcome whenever the government chooses to overcome it. It seems obvious to all who consider the question here that government ownership of many well scattered airdromes is the only way to avoid monopoly of air travel by a few wealthy companies, and at the same time encourage private and amateur flying, from which, of course, will spring both new inventions, ideas, pilots and demand for machines.

All these questions have been taken up at length and in detail by the Civil Aerial Transport Committee, and presented with force and effect from both sides. Just what the government will do, or when it will do it, no one knows. That it will do something, and that soon, and that in one way or another England in particular as well as the Empire in general, is about on the threshold of the greatest single transportation effort of her national life cannot but be obvious to any one who sees on the one hand a mighty industry, on the other government determined to have an empire reconstructed in every way, and particularly in an economic way and, standing between, the best legal, social, technical, political and economic brains of the empire, all bent on devising the best way in which the country can make the best use of her war-forged industry!

Isn't it about time *we* of the United States began to ask *ourselves* what *we* are going to do with *our* mighty airplane industry and what part *our* government is going to play in *our* development of *our* civil aerial transport, besides establishing a few airplane mail routes?

The New York Aeronautical Exposition

THE whole story of aviation is told at the New York Aeronautical Exposition, held in New York City from March 1st to 15th. Not only are there to be found all the well-known airplanes of the war, with such familiar names as the De Havilland-Four, Caproni, Spad, Curtiss flying boats, S. E.-5, Nieuport, Fokker and Handley-Page, but also the forerunners of the coming era of civilian flying. One leaves the Exposition with a dazed sense of the recent advances made in aviation, even if one has been a pretty close student of the subject.

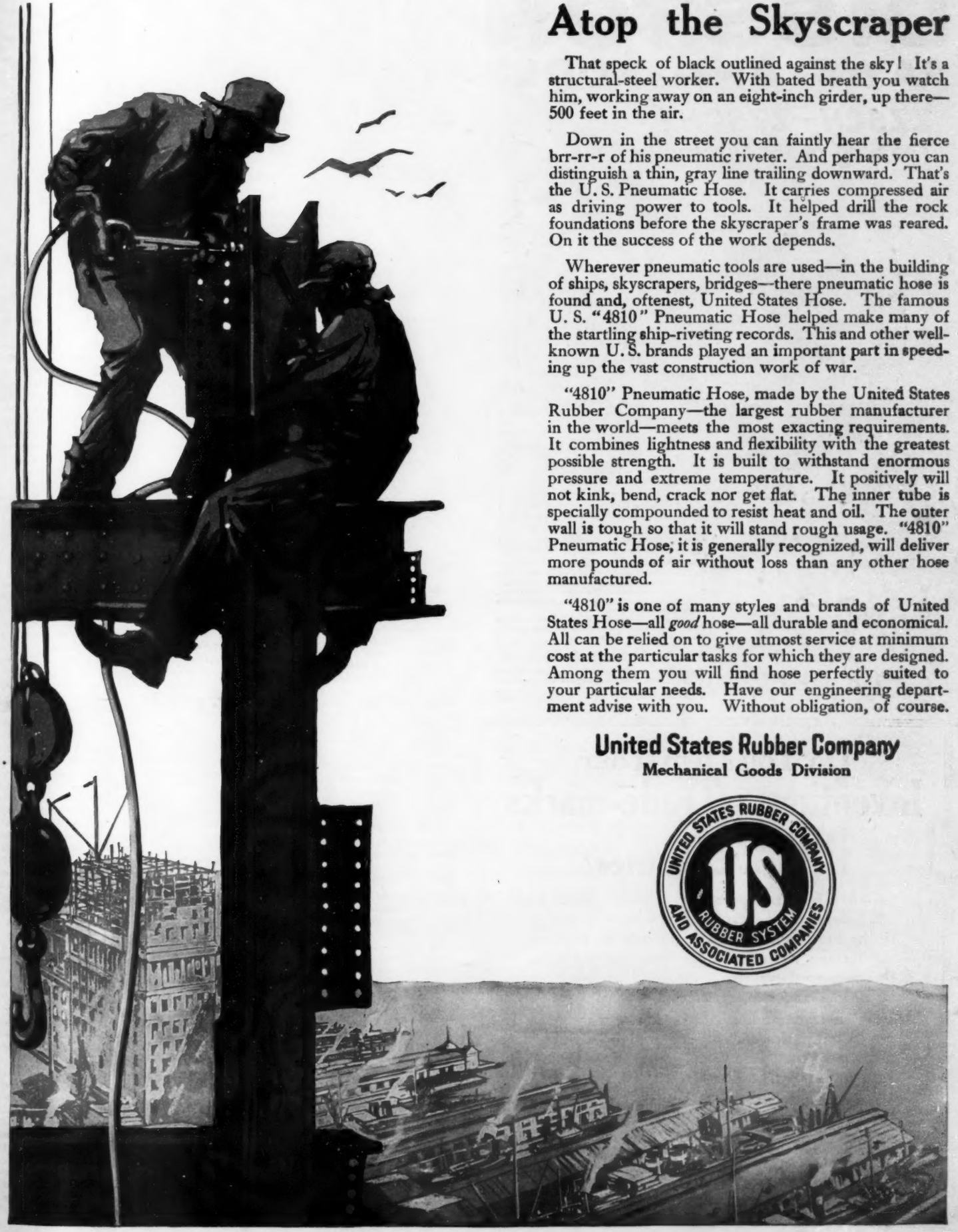
With the signing of the armistice the various late belligerents have naturally disclosed their heretofore closely guarded secrets. So the exposition is replete with fighting machines about which we have read so much in the recent past. Such is a more or less battle-worn Spad biplane, which is mysteriously camouflaged in pale green and chocolate brown; a British S. E.-5, with its curiously hinged Lewis gun over the top plane; and a Baby Nieuport with its rotary engine plainly showing behind the tractor screw.

Then there are the planes developed in America toward the closing days of the fighting, and which were never brought to bear on the Germans. Typical of such machines is the Loening monoplane, with its queer deep bellied body, simple struts, and sinister black coat over all. This machine, despite its unconventional design, has broken numerous records and promised to be a veritable terror if it ever reached the front. There is also the Glenn Martin bomber—a twin-engined plane with a span of over 100 feet—which was developed too late to be used against the enemy. This plane compares favorably with the Handley-Page, which was extensively used for bombing purposes during the last year or more of the war.

All the war machines bristle with machine guns. From every angle and opening, a machine gun seems to stare one in the face as one views these fighters. An inspection of the crew's quarters never fails to disclose the real purpose of the machines, for ammunition belts or Lewis gun pans are always in evidence. Other machines of the night and day bombing types, have in addition to their machine guns the bomb racks under the lower wings, and suitable sighting devices. The De Havilland-Four general utility plane, which we succeeded in putting into quantity production and which appeared over the battle front in large numbers, has been the center of considerable attention; and naturally so, for there is certain to be more interest in a machine that has seen service than in one that was to see service and didn't.

There is no end to the war revelations. Among the exhibits are the wonderful cameras used to record enemy positions

(Continued on page 272)



Atop the Skyscraper

That speck of black outlined against the sky! It's a structural-steel worker. With bated breath you watch him, working away on an eight-inch girder, up there—500 feet in the air.

Down in the street you can faintly hear the fierce brr-rr-r of his pneumatic riveter. And perhaps you can distinguish a thin, gray line trailing downward. That's the U. S. Pneumatic Hose. It carries compressed air as driving power to tools. It helped drill the rock foundations before the skyscraper's frame was reared. On it the success of the work depends.

Wherever pneumatic tools are used—in the building of ships, skyscrapers, bridges—there pneumatic hose is found and, oftenest, United States Hose. The famous U. S. "4810" Pneumatic Hose helped make many of the startling ship-riveting records. This and other well-known U. S. brands played an important part in speeding up the vast construction work of war.

"4810" Pneumatic Hose, made by the United States Rubber Company—the largest rubber manufacturer in the world—meets the most exacting requirements. It combines lightness and flexibility with the greatest possible strength. It is built to withstand enormous pressure and extreme temperature. It positively will not kink, bend, crack nor get flat. The inner tube is specially compounded to resist heat and oil. The outer wall is tough so that it will stand rough usage. "4810" Pneumatic Hose, it is generally recognized, will deliver more pounds of air without loss than any other hose manufactured.

"4810" is one of many styles and brands of United States Hose—all *good* hose—all durable and economical. All can be relied on to give utmost service at minimum cost at the particular tasks for which they are designed. Among them you will find hose perfectly suited to your particular needs. Have our engineering department advise with you. Without obligation, of course.

United States Rubber Company
Mechanical Goods Division

UNITED STATES RUBBER COMPANY
US
RUBBER SYSTEM
AND ASSOCIATED COMPANIES

The New York Aeronautical Exposition

(*Continued from page 270*)

and movements, some of which expose almost one hundred large negatives at one loading. There are those cameras known as gun cameras which have been employed in training our aerial marksmen. One type makes use of standard motion-picture film, can be applied to any standard machine gun, and takes pictures as long as the trigger is pulled. The "shots" are counted automatically. The pictures when developed show the sights in position on the airplane or other target, so that the accuracy of aim can be checked.

But it is the civilian aspect of aviation that is no doubt the greatest surprise in store for the visitor to the Exposition. There are civilian planes selling in the neighborhood of $3,000 which are attracting not only the attention of the curious, but that of buyers as well. When the Exposition was only four days old, a manufacturer of a small civilian plane selling for $3,500 had taken in eight orders, with several promising prospects in addition. This plane is a two-seater, arranged with side-by-side seats, driven by two two-cylinder engines which operate twin "pusher" propellers at the rear of the single plane, through suitable gears and shafting. Being a monoplane, its wing spread is considerable; but in every other respect the machine is primarily an "everyman's" machine.

There are single-seater civilian planes selling for as low as $2,500, with wing spreads less than 20 feet, which means that they can be readily stored in one's private garage. Sturdy, neat, simple to handle, little to get out of order, such planes are bound to become quite common in the very near future. Making a speed of 80 miles an hour or better, such planes bring distant towns, say those 200 miles away, within a relatively short flight. The commuter of the near future may live 150 miles away from his business, yet he can come to work within an hour and a half. The whole problem just now is a matter of suitable landing fields close to the business sections of all cities. For it is obvious that it would gain an aerial commuter little if he could fly at the rate of 100 miles an hour for about an hour, only to land 15 miles from his office and then require an hour to travel by the usual surface means from the airdrome to the office.

All in all, the Exposition is a revelation. At a glance it tells what has been done in captive balloons, odd airplanes, huge bombing and passenger-carrying planes, dirigibles, dependable power plants, accessories, seaplanes, armament, and so on. It also holds forth definite promise for the civilian aspect of flying; there can be no doubt that it means to tell us that civilian flying is about to be realized on a vast scale.

Electric Light and Egg Production

ON numerous previous occasions it has been claimed that hens could be made to lay more eggs by supplying them with artifical light; but the suggestion has always looked a good deal like perpetual motion. Those who have brought it forward have not sufficiently realized that a hen is merely an egg factory; that from a given amount of feed she can make just so many eggs, and no more; that the proposition as ordinarily expressed, of increasing her lay by fooling her as to the duration of daylight, is neither more nor less than a miracle, and therefore an object of derision in these hardheaded days.

Perhaps the outstanding event in 1918, from the dairyman's point of view, is the demonstration that this claim is after all valid, and that it rests upon a perfectly good foundation of science and economics and common sense. It is not the use of illumination makes a hen lay more eggs, in the long run; it does nothing of the sort. But—it makes her lay eggs in the winter, when eggs are worth more. That's all there is to it.

Any illumination will do, so long as it is strong enough; but electricity is preferred over gas and kerosene because of its convenience and safety. The light is supplied in November, December, January and February, the months of shortest days and, under old conditions, of lowest egg yield. On some farms the method is to light up at 5.30 A. M., to switch off at daylight, and again to light the chicken pens from dusk till 7.30 P. M. Equally good results are obtained by supplying light only in the evening, in which case the illumination lasts till 8 or even 9 o'clock.

The procedure owes its present vogue to an accident. A south California producer installed lights in his runs so that he could more conveniently display his stock to prospective buyers after dark. He was led to suspect that the lights, often on, made the hens lay better. He experimented, and with astonishing results. Now his technique is practiced all over California, and is spreading fast.

There is no mystery or miracle about it. The physiological fact is that in the winter season of short days, when the hens are allowed to follow their instincts, they are on the roost 15 hours or longer. They consume so little food under these conditions, and get so little exercise, that they cannot by any possibility manufacture many eggs. Make their night shorter, so that they eat more and exercise more, and they will automatically give more eggs. Of course, the hen that eats more and produces more eggs and works a longer day, under the electric lights through the winter, will often go into spring moulting, and in any event there will be a notable drop in her March-April-May lay, at the season when ordinarily she would yield most eggs. But she has given eggs when eggs were most valuable, and so is entitled to rest up a bit when the season of egg plenty has arrived.

Professor Rice of the Cornell poultry department early got in touch with this development, and inaugurated experiments, both at Ithaca and at farms throughout the state, in November, 1917. He is led by his investigations to believe that a division of the hen's 24 hours into 12 of ample illumination and work, and 12 of rest on the roost, obtains the best results. In a recent lecture, Professor Rice gave figures for two flocks of 100 birds each, one on the lighting system and the other without lights. The hens kept in the old way actually outlaid the others, 4,362 eggs to 4,286 from December to June, inclusive; but the eggs produced under artificial light brought $60 more, with a total income 40 per cent better.

Professor Rice has pointed out admirably the advantage which this gives the producer of eggs. Not alone do the poultrymen get high-priced eggs from the fowls and pay for them in low-priced eggs, but they control production in a way that makes them better able to supply their trade. Their great problem in the past has been that they could not contract to deliver eggs the year round, because during the winter months they did not have the eggs.

Steel-Grip Gloves

A NEW steel-grip glove has been placed on the market by a Chicago company. The glove proper is made of chrome leather and sewed close with steel thread. This means that the glove is rip-proof. Men working at the hammer and furnace handling hot steel experience a good deal of trouble with their ordinary cloth gloves tearing or burning through. In the above style glove this is practically impossible and their palms, fingers and thumbs are reinforced with small steel ribbons. They are clinched with a patented process so that the workman cannot hurt his hand. This type of glove is flexible, pliable and comfortable and can be used not only by men at the furnace but by the men handling stock in the shop or steel shed. These gloves are approved by a number of safety engineers in the country and reports show that they prevent accidents and incidentally costly delays in production.

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(14303) B. L. B. says: The question of Charcoal Heaters burning in refrigerator cars was being discussed at a meeting of Railroad men, and the point arose whether or not in a refrigerator car, which had been papered and boarded up to make it practically air tight, if a heater burning charcoal would not, within 24 hours, burn the oxygen out of the air to such an extent that it would retard the combustion of the charcoal. I might add that these Charcoal Heaters will burn in that length of time about two bushels of charcoal, and that the air space in one of these cars would be about 3,000 cubic feet. It was my contention, the cars should be opened every 24 hours to allow fresh supply of air to enter in order best possible combustion of fuel be obtained. A. It is usually assumed that 152 cubic feet of air are necessary for the complete consumption of 1 pound of carbon. In two bushels of best charcoal there are 40 pounds, of which about 32 pounds are carbon and the rest is ash. If 152 cubic feet of air are needed to consume one pound of carbon, 32 pounds will require about 5,000 cubic feet of air, and the car you say has but 3,000 cubic feet of space. If the air becomes too poor to support combustion of charcoal the fire will go out, unless air is drawn in from the outside. This is probably the case. It would be very difficult to make a car air tight. At just what degree of impoverishment the air ceases to be able to support combustion is not very certain. Then, too, the carbon dioxide from the combustion of the coal adds to the impurity of the air and hastens the time when the fire must expire. We should say that it would be very necessary to change the air in the car very completely before any man could go into the car to work.

(14304) J. E. R. asks: The question has been raised in discussion whether or not the soldiers in France can see or hear shells fired by high powered guns, in time to dodge them. Will you please answer this question for us if you have information available? A. Sound travels in warm weather 1,120 feet per second. A high powered rifle produces a much greater velocity in the shell. The sound of the gun cannot be heard before the shell reaches the place to which it is sent. Nor can an object moving past one with such a velocity be seen. If it were coming directly towards one it might be seen when near enough to fill a perceptible angle. That shells have been seen to go past rests upon very uncertain foundations.

(14305) D. B. asks: In our Physics class at High School the question was brought up: "Will a ship sunk in deep water sink to the bottom?" In my opinion any ship once sunk will sink to the bottom of the ocean even in depths of five miles or more. I understand thoroughly how those who believe the opposite, explain their belief, but I cannot see any strength in these arguments. I understand how the enormous pressure at great depths might crush any bulkheads, but I cannot see that it would have any effect upon the sinking of the ship. A. The enormous pressure at great depths in the ocean have nothing to do with the sinking of a body, any more than the enormous pressure of the air upon our bodies has to do with our falling through the air. We fall through the air because we are heavier than the same volume of air, and the pressure of the air upon us is equal in all directions. We move almost as if there were no pressure at all upon us. An iron ship falls in the water because it is heavier than its bulk of water. The pressure bursts the bulkheads in and it falls faster because its bulk has become smaller and therefore, its weight greater with reference to the water. Water is practically incompressible and weighs only about a fifth more per cubic foot at the bottom of the deepest ocean than it does at the surface. Iron is 7.7 times as heavy as water and therefore, never can stop sinking when put into water. A ship goes directly and swiftly to the bottom when it goes under the water.

(14306) F. D. A. asks: It is a fact that in a dwelling house or building where there are both cold water pipes and hot water pipes, that when the weather gets cold the hot water pipes always freeze and burst before the cold water pipes do. It is also a fact that if you run your automobile until the water in the radiator is hot or boiling and put your automobile in a garage with other automobiles which have not been run, that the radiator on your automobile is quite often the only one in the garage to freeze and burst. There is a reason for everything. Please tell us the reason of this. A. It is believed that the hot water pipes freeze before the cold water pipes because the air has been driven out of the water when it was heated and the water radiates its heat more rapidly for that reason.

NEW BOOKS, ETC.

MODERN SHIPBUILDING TERMS. Defined and Illustrated. By F. Forrest Pease, Staff Instructor, Education and Training Section, Emergency Fleet Corporation. Philadelphia and London: J. B. Lippincott Company, 1918. 8vo.; 143 pp. text and 82 plates. Price, $2 net.

If the standardization of shipbuilding is to produce the best possible results it must be accompanied by a standardization of terms. A highly competent man here defines 2,000 terms, of which 350 are illustrated; these illustrations, together with the series of photographs showing the progressive steps of construction, constitute a graphic exposition of practice, picturing every operation in process and finished. The use of the tools and machinery is shown, and the relation of work on parts to the completed ship is explained. The work will aid in the reading of blue prints, will convey a rounded concept of the modern system of shipbuilding, and is a splendid silent partner for both yard and office men.

MILITARY GEOLOGY AND TOPOGRAPHY. Herbert E. Gregory, Editor. New Haven: Yale University Press. 8vo.; 296 pp.; illustrations. Price, $1.25.

This text focuses attention on the principles and facts applicable to military problems, and provides the nucleus of a course that is in the nature of a response to the War Department's recommendation that military geology and geography be more widely taught, both as an aid in conducting military operations and in the solution of economic problems relating to raw materials. An imposing array of qualified instructors, from college professors to Government scientists, have collaborated to devise a simple and efficient text, with the result that this book offers attractive means to the desired end. Rocks, streams, lakes, water supply, and land forms are described, formations and the principles governing them are lavishly illustrated, and there are chapters on map reading and interpretation, and the economic relations and military uses of minerals.

THE PHONOGRAPHIC DICTIONARY AND PHRASE BOOK. By Benn Pitman and Jerome B. Howard. Cincinnati: The Phonographic Institute Company, 8vo.; 552 pp. Price, $3.

This very complete dictionary of 120,000 words has practically every useful word in the language; many proper and geographical names, legal, scientific and technical terms are also included, each clearly engraved in phonography opposite the key-word in ordinary type, with information as to spelling, accentuation, pronunciation, capitalization, fully vocalized phonographic form, reporting style outline, etc. The work, while of the highest value to all aiming at proficiency, will be particularly appreciated by the self-instructed or those entering upon practical experience as amanuenses or reporters. Properly used, the dictionary will convey that unhesitating accuracy which is the goal of the earnest student.

THE FARMER HIS OWN BUILDER. By H. Armstrong Roberts. Philadelphia: David McKay, 608 South Washington Square, 1918. 8vo.; 301 pp.; 170 illustrations. Price, $1.25.

The farmer with but a limited knowledge of building construction will find here a practical guide for the erection of country dwellings, barns, and other farm buildings. The necessity for limiting expenditure has been fully taken into account, and the plans given may usually be modified to suit individual requirements. There are points on the preparation of plans and specifications, on figuring the required materials, on building the foundations, framing the skeleton, and covering in, and on concrete construction and the use of stucco. The book tells how to install a sanitary disposal system, how to replace defective foundations with concrete, and how best to use the work bench and tool cabinet. There are good full-page plates, numerous plans, and many smaller illustrations offering detailed and practical suggestions.

ELECTRO-ANALYSIS. By Edgar F. Smith. Philadelphia: P. Blakiston's Son and Company, 1918. 8vo.; 344 pp.; 47 illustrations. Price, $2.50 net.

The electric current, its source, reduction, and measurement, and its utilization in the electro-chemical laboratory, occupy the preliminary pages of this work. Theoretical considerations are so

presented as to illuminate the behavior of metals in solution and explain some of the obscure reactions. Other chapters deal with rapid precipitation, the use of mercury cathode, the determination and separation of metals, the determination of the halogens and of nitric acid, special application of the rotating anode and mercury cathode, oxidations by means of the electric current, and the combustion of organic compounds. Halide analysis by the improved double-cup method, and most other advances of proved efficiency, are noted in the volume.

A WONDER BOOK OF RUBBER. Akron, Ohio: The B. F. Goodrich Rubber Company. 8vo.; 72 pp.; illustrated.

This is a brightly-written and well-printed little volume designed to satisfy curiosity as to rubber and the rubber industry. It tells what rubber is, where it comes from and the processes that turn it into the innumerable finished articles of utility. The upbuilding of the industry is sketched in such a way as to create enthusiasm in the reader. Fifty thousand different rubber articles are today in use; the prophecy is ventured that within ten years the number will be doubled, perhaps tripled. It took the white man 300 years to improve upon Indian methods of manufacture, but progress has since then been magical.

GASOLINE AND KEROSENE CARBURETORS. Construction, Installation, Adjustment. By Victor W. Pagé, M.S.A.E. New York: Scientific American Publishing Co., 1919. 8vo.; 213 pp.; fully illustrated. Price, $1.50; by mail, $1.65.

Each succeeding day brings more forcibly home to users of internal combustion motors the necessity for measures that shall to some extent offset the scarcity and rising cost of gasoline; the burden, lying most heavily upon industry with its great, ever-hungry trucks to feed, and upon agriculture with its hard-laboring tractors, must eventually be shifted to the shoulders of the ultimate consumer, so the problem and its solution is of universal interest. Our first concern should be, as in all problems of economy, to find any existing leaks and to stop them so far as is humanly possible. Beyond question there is a constant, and in the aggregate an appalling, waste of fuel chargeable to the users' ignorance of carburetor construction and adjustment. Education is the only remedy, and it is this remedy that Capt. Pagé applies in his excellent new work on the carburetor. Since few repairers and drivers of cars, trucks and tractors are technically trained men, it is necessary to place the matter before them in the simplest possible words; and the many familiar with and benefitting by the author's numerous works on automobiles and engines will not need to be assured of the ease with which the practical man and the average motorist may assimilate and apply the information here given. The introductory chapter takes up the liquid fuels suitable for power—the compounds derived from crude petroleum, the specifications, basic test and refining methods of gasoline; kerosene, alcohol, alcohol benzol mixtures, solid gasoline, camphor and gas. It takes into consideration the cheapness of the heavier grades of gasoline, the special vaporizers required by kerosene, the demands of the heavy-duty engine, the Diesel system, and liquid fuel storage. The succeeding chapter on liquid fuel supply methods describes gravity supply, pressure feed, the vacuum tank, the diaphragm pump, the Church and thermo vacuum feeds, and the utility of gasoline strainers. The third chapter arrives at carburetor action and construction, with a clear outline of principles and a statement of what the efficient carburetor must do—that is, it must not only produce an explosive gas, but must also deliver a mixture, accurately proportioned, that will maintain the proper composition at all engine speeds. This point is not left until the importance of gradual acceleration and the interrelations of throttle-opening, speed, and richness of fuel are thoroughly plain to the reader. The elements of carburetor design are then set forth with the greatest simplicity; features such as auxiliary air valves for automatic mixture compensation, the Venturi-type mixing chamber, float and mixing chamber concentric, and the separate adjustment for gas and air, are explained in everyday language accompanied by exact engineering drawings. The chapter on modern gasoline carburetors presents all leading types, with cross-sectional views that disclose all parts in their proper relationships. Coming to the kerosene carburetor, we have what is undoubtedly the most complete exposition to be found of a device that holds great promise and is occupying the attention of many investigators. The progress made is sketched, the difficulties are coupled with suggestions for overcoming them, and the advantages and disadvantages of each method are weighed, with particular reference to the tractor: preignition troubles, the clearance and cooling of the pistons, and direct injection supply are but a few of the points dealt with, and numerous vaporizers designed to use kerosene are shown in detail. A valve that allows the successful use of a gasoline-kerosene mixture with almost

any engine is also described and illustrated. There is a valuable chapter on manifolds and carburetor installation, and the final chapter deals at length with carburetor faults, location and remedies; here it is demonstrated that a little knowledge can be made to take the place of a great deal of gasoline, and the man who learns adjustment from these simple instructions may gauge the increase in his efficiency by the decrease in his fuel bill; he will readily place and remedy such troubles as obstructed fuel feed and constricted gas or air pipes, and will know how to solder a float, repair a manifold, test a float level, and cope with the many little annoyances that mean lost fuel and power. Those whose business or pleasure brings them into a responsible relationship with internal combustion engines, and especially those who pay the bills, will not be slow in acknowledging a debt of gratitude to this timely and comprehensive treatise.

INVENTOR'S MANUAL. How to Work a Patent to Make It Pay. By George M. Hopkins, Experienced Inventor. Revised by A. A. Hopkins, Member of the American Statistical Association. New York: The Norman W. Henley Publishing Company, 1918. 8vo.; 151 pp.; illustrated. Price, $1.25. Postpaid, $1.30.

There can be no real success for a device, or for its inventor, until creative energy has been harnessed up with business knowledge and ability. The inventor must have certain facts in his possession if he is to protect himself against incompetence and sharp practice. "The Inventor's Manual," written by authorities whose experience and qualifications are beyond question, has no ax to grind; its sole object is to see that the inventor makes the most of his rights and privileges, and to smooth the way to this necessary alliance of invention and promotion. The introductory pages consider what classes of invention offer the best pecuniary returns; this of course hinges upon the number of individuals it is possible to interest, and farther on we have the population of the country as represented by occupations—a most desirable guide to the number of consumers an agricultural, manufacturing, household, or other device may be expected to attract. The tabulation of cities according to population, and of states by counties, is a distinct help in planning the advertising campaign, in the assignment of territorial grants, and in the placing of a fair price on patent rights. Much space is properly devoted to the adequate protection of a patent. Should a man draft and prosecute his own application? The answer to this important question is unequivocal and enlightening. How shall he select a competent attorney? Without mentioning any names it is shown that the profession has been invaded by many unscrupulous men who, by misleading advertisements and promises, trap the unwary. When lured by the "No patent, no pay" slogan, it is well to remember that a patent may not be worth the paper it is printed on, and that the attorney who misrepresents his office as a charitable institution is unlikely to be scrupulously honest in his dealings. The veil is torn from the many fraudulent schemes launched at an inventor as soon as his name appears in the *Official Gazette*. These plausible letters from pretended advertisers, brokers and buyers always end with a request for a few dollars, or a few hundred, before the transaction can be completed. Fortified with the knowledge here conveyed, the inventor may smile at the transparent tricks of the sharper. The book does not confine itself to mere warnings; it offers positive aid in every conceivable emergency. Money is needed for developing a device or obtaining a patent; often the inventor carelessly assigns an undivided interest to his creditor. Fair and properly-drawn forms for such assignments, for territorial interests, and for licenses, are given. Among a treasury of valuable advice may be found hints for the exhibit of an invention; design patents are presented as a neglected but profitable field, the relations of inventor and promoter are studied, and the plates are excellent examples of Patent Office drawings. The authors bring simple business wisdom to bear at every step in the perfection and exploitation of the patented device; the Manual answers all the questions a host of inventors are asking, and a knowledge of its contents will save them effort, time and money, avert disappointment, and not infrequently turn failure into success.

THE FLYING BOOK. Edited by W. L. Wade. New York and London: Longmans, Green and Co., 1918. 8vo.; 275 pp.; illustrated. Price, $1.75 net.

Although handicapped and delayed by war conditions, this British annual carries much recent information that will commend it to varied interests. Part I has six special articles on aeroplanes and airships and commercial aeronautics, and sections dealing with war aeroplanes, history, engines, and records. Part II lists aeronautical organizations, has an industrial directory of American, British, French and Italian firms, and presents, "Who's Who" in aeronautics. Part III tabulates trade periodicals, air raids, etc., describes the Royal Air Force and gives its honor list, and adds a glossary of aeronautical terms. Half encyclopedia, half directory, it creditably discharges a useful service.

MODERN CHEMISTRY AND CHEMICAL INDUSTRY OF STARCH AND CELLULOSE. (With Reference to India.) By Tarini Charan Chaudhuri, M.A. Calcutta and London: Butterworth and Co., 1918. 12mo.; 156 pp.; illustrated. Price, Rs. 3.12 net.

The two parts of this little work study an important subject from two viewpoints—the theoretical, and the industrial. The first part concerns itself with primary uses and nomenclature, general chemical character, synthesis in the plant system and theories on the mechanism, and industrial training and education in India. The second part briefly deals with the many industrial applications, such as higher alcohols, artificial rubber, textile fibers, paper, artificial silk and chemical food, and concludes with a chapter on recent advances and the outlook for India's industrial future.

SCIENTIFIC POTATO CULTURE. By A. J. Young, Sr. Huntington Beach News, Huntington Beach, Cal., 1918. 8vo.; 90 pp.; illustrated. Price, $2.

This book was written after 23 years of experimentation in potato culture, and contains concise suggestions on breeding, selections and care of the seed potato, cutting and preparing the seed, planting, cultivation and irrigation, disease and its prevention, and harvesting and marketing. Numerous full-page plates add to the attractiveness and utility of the little volume.

THE PHONOGRAPHIC AMANUENSIS. By Jerome B. Howard. Cincinnati: The Phonographic Institute Company, 1918. 12mo.; 224 pp. Price, $1.

This presentation of Pitman phonography is particularly adapted to schools that instruct and train shorthand amanuenses; each of the graded lessons is devoted to the development of a single broad feature of the system. Among noteworthy changes in the revised edition are the introduction of the principle of tripling straight strokes, some alterations in usage with respect to logograms and contractions, and other improvements that mean greater simplicity and increased efficiency.

HENDRICKS' COMMERCIAL REGISTER OF THE UNITED STATES. New York: S. E. Hendricks Co., Inc., 1918. 4to.; 2381 pp. Price, $10.

The twenty-seventh annual edition of this creditable directory offers its customary wide service to buyer and seller. It devotes itself especially to the interests of the electrical, engineering, iron, hardware, mechanical, mining, quarrying, chemical, railroad, architectural and contracting industries; for all supplying, or being supplied, by these or kindred industries, it presents unsurpassed lists of producers, manufacturers, dealers and consumers. Its arrangement facilities a prompt and satisfactory response to any need, nor does the above list of interests by any means exhaust the resources of the work. Multitudinous products are included, from raw material to finished article, with the concerns handling them, from producer to consumer. Since its information is obtained directly from the concerns listed, and is corrected up to the latest possible moment, it is worthy of implicit confidence. The arduous task of collecting, arranging and publishing this material has been accomplished in a highly commendable manner.

CHEMICAL ENGINEERING CATALOG. 1918. New York: The Chemical Catalog Company, Inc. 4to.; 836 pp. Price, $5.

Now that we have at last entered upon an era of chemical independence and expansion, a comprehensive directory and catalog of this kind is of the greatest value to chemical engineers and buyers seeking information on chemical and metallurgical equipment, machinery, chemicals and supplies. This, the third annual edition, shows a really phenomenal growth and improvement that reflects recent progress in the chemical industries; it combines and condenses many catalogs into one book, indexed and cross-indexed so that to find any desired information is an easy matter. The work is published under the supervision of a committee appointed by The American Institute of Chemical Engineers, The American Chemical Society, and The Society of Chemical Industry, and is loaned free of charge to those in responsible positions in manufacturing establishments, to engineers in chemical lines, and to the heads of chemical departments in colleges and technical schools. Its inclusion of dyestuffs, alloys, ores, oils, and such miscellaneous materials as are rapidly being adapted by the chemical engineer to uses not hitherto deemed within his province, enlarges the appeal of the work and vastly increases its usefulness.

CLARK

Rear Axles · Steel Wheels · Locking Differentials
For Motor Trucks

EQUIPMENT

Clark Disc Steel Wheels Give Long Life to Trucks

Good or bad roads have no terrors for Clark Equipped Trucks. Clark Disc Steel Wheels will outwear any truck; they require no attention.

Clark axles give 12 to 14 inches road clearance.

Clark Equipment is found only on good motor trucks.

CLARK EQUIPMENT COMPANY
BUCHANAN — MICHIGAN

COLGATE'S

"HANDY GRIP"
PATENTED 1917

Saving Stick

—like putting a new blade in your razor

DID you know that you can renew your shaving stick just as easily?

You can—with Colgate's Handy Grip. The stick is threaded—and screws into the metal Grip. When it is nearly gone screw out the stub and screw in a Colgate "Refill" stick—which comes all threaded to fit. This saves you the price of a new metal box.

You can wet the stub and stick it on the "Refill" too—adding **50** cool, comfortable Colgate shaves. Do this for thrift instead of throwing away the stub.

COLGATE & CO. Dept. 40, 199 Fulton Street, New York

Some men still prefer to shave with a Cream though it is the least economical way. To these men, this friendly word: Clip this paragraph and mail it to us before April 5th, 1919. We will send you, free, a trial tube of Colgate's Perfected Shaving Cream. You cannot be sure you know the best till you have used Colgate's. But we give you the impartial advice to use the Handy Grip as the most convenient and economical way to shave. We can do this impartially as we make all three forms of shaving soap—Stick, Powder, and Cream.

The only Refill Shaving Stick